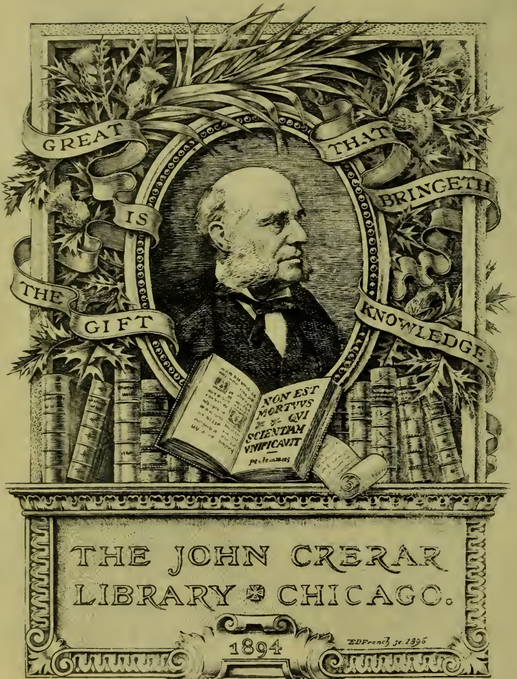

THE GIFT IS GREAT THAT BRINGETH KNOWLEDGE
NON EST MORTVVS QVI SCIENTIAM VNIFICAVIT
Ptolemæus
THE JOHN CRERAR LIBRARY CHICAGO.
1894
EDFrench sc. 1896

PRESENTED BY
Ohio State University.

Digitized by the Internet Archive
in 2013

http://archive.org/details/collegeofenginee19ohio_3

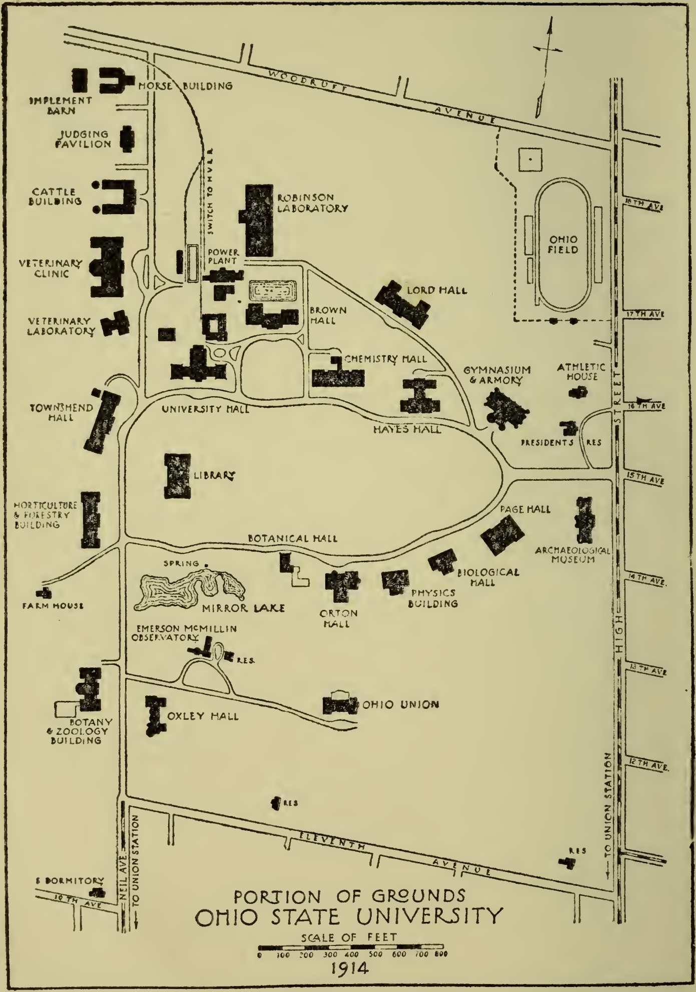
8.971
Oh Z30

The Ohio State University Bulletin
VOLUME XIX JANUARY, 1915 NUMBER 10

COLLEGE OF ENGINEERING

1915-1916

PUBLISHED BY THE UNIVERSITY AT COLUMBUS
Entered as second-class matter November 17, 1905, at the postoffice
at Columbus, Ohio, under Act of Congress, July 16, 1894



PORTION OF GROUNDS
OHIO STATE UNIVERSITY

SCALE OF FEET

1914

UNIVERSITY CALENDAR

1915

Entrance examinations, Tuesday to Saturday, June 8 to 12, 8 a. m.

Summer Session, June 21 to August 13.

Entrance examinations, Tuesday to Saturday, September 14 to 18, 8 a. m.

Registration Day—First semester, Tuesday, September 21.

President's Annual Address, Friday, September 24, 11 a. m.

Latest date for registration of candidates for a degree at the Commencement of June 1916, Friday, October 1.

Registration Day, Three-Year Course in Agriculture, First Term, Monday, October 11.

Date for mid-semester reports to the Deans concerning delinquent students, Wednesday, November 17.

Thanksgiving recess begins November 24, 6 p. m., and ends November 30, 8 a. m.

Christmas recess begins Saturday, December 18, 12 m.

1916

Christmas recess ends Tuesday, January 4, 8 a. m.

Registration Day, Three-Year Course in Agriculture, Second Term, Tuesday, January 4.

Final examinations Thursday, January 27, to Thursday, February 3.

First semester ends Thursday, February 3, 6 p. m.

Registration Day—Second semester, Tuesday, February 8.

Washington's Birthday, Tuesday, February 22.

Close of Second Term, Three-Year Course in Agriculture, Friday, March 17.

Mid-semester reports to the Deans, Saturday, March 18.

Easter recess, Thursday, April 20, 6 p. m., to Tuesday, April 25, 8 a. m.

Memorial Day, Tuesday, May 30.

Competitive Drill—Cadet Regiment—Saturday, June 3.

Commencement, Tuesday, June 6.

Final examinations, Wednesday, June 7, to Wednesday, June 14.

Entrance examinations, Tuesday, June 20, to Saturday, June 24, 8 a. m.

Withdrawn
~~398636~~
196107

378.771
OhZ30

ADMINISTRATION

Board of Trustees

JULIUS F. STONE	Columbus
GUY W. MALLON	Cincinnati
OSCAR E. BRADFUTE	Xenia
FRANK E. POMERENE	Coshocton
BENJAMIN F. MCCANN	Dayton
JOHN F. CUNNINGHAM	Cleveland

Administrative Officers

President..............................WILLIAM OXLEY THOMPSON
Office: University Hall—99312; N. 476
Residence: University Grounds—2056

Secretary of the Board of Trustees and Business Manager.......................................CARL E. STEEB
Office: University Hall (East End)—99332; N. 32
Residence: 1956 Iuka Ave.—5835

Registrar, University Editor and Secretary of the University Faculty ....EDITH D. COCKINS
Office: 101 University Hall—99314
Residence: 1348 Neil Ave.—16310

Entrance Secretary...........................LESTER E. WOLFE
Office: 100 University Hall—99353; N. 939
Residence: 1546 Neil Ave.

Executive Clerk..........................KATHARINE H. DUNCAN
Office: University Hall—99312; N. 476
Residence: The Normandie—5026

Cashier..................................BESS C. WATTERS
Office: University Hall (East End)—99332; N. 32
Residence: 1851 N. Fourth St.—N. 2108

College of Engineering

Dean......................................EDWARD ORTON, JR.
Office: 131 Lord Hall—99331
Residence: 629 E. Broad St.—3935

Secretary ....EDWIN F. CODDINGTON
Office: 131 Lord Hall—99331
Residence: 426 Fifteenth Ave.—17520

THE OHIO STATE UNIVERSITY

The Ohio State University, located in Columbus, is a part of the public educational facilities maintained by the State.

Organization

For convenience of administration, the departments of the University are grouped into organizations called colleges. The Ohio State University comprises ten colleges and a graduate school, each under the administration of a Dean and College Faculty, as follows:

Graduate School
College of Agriculture
College of Arts, Philosophy and Science
College of Education
College of Dentistry
College of Engineering
College of Homeopathic Medicine
College of Law
College of Medicine
College of Pharmacy
College of Veterinary Medicine

SUMMER SESSION

In addition to the above, there is a Summer Session under the supervision of a Director and governing committee for the administration of the regular University courses offered in the summer.

This bulletin of announcements is devoted exclusively to the work of the College of Engineering, offered during the academic year beginning September, 1915.

[*Note*—The University publishes a bulletin descriptive of each College. Copies may be obtained by addressing L. E. Wolfe, Secretary of the Entrance Board, Columbus, Ohio, and stating the College in which the writer is interested.]

u

THE COLLEGE OF ENGINEERING

The purpose of the College of Engineering is to instruct students in the fundamental sciences and arts, upon which all engineering rests, and to impart such special and technical knowledge of the various branches of engineering as will enable its graduates to enter them and maintain themselves while gaining their professional experience. To accomplish this purpose, the work of the College is classified under eight curricula, which are described on the following pages and which lead to the following degrees:

Bachelor of Architecture (B. Arch.)
Bachelor of Ceramic Engineering (B. Cr. E.)
Bachelor of Chemical Engineering (B. Ch. E.)
Bachelor of Civil Engineering (B. C. E.)
Bachelor of Electrical Engineering (B. E. E.)
Bachelor of Mechanical Engineering (B. M. E.)
Bachelor of Engineering in Mining (B. E. M.)
Bachelor of Engineering (B. E.)

The curriculum leading to the degree of B. E. is offered for the benefit of those students who may desire instruction not included in any one of the special curricula, and also for those who may wish an opportunity to pursue a limited number of cultural studies, together with elective engineering studies. It is believed, however, that the severe mental dicipline of any of these curricula makes the work of the College of Engineering the equal of any other in general educational value.

FIVE-YEAR CURRICULUM

For the benefit of those who are unable to carry the full schedule, on account of outside work for self-support, impaired health, or any other valid reason, any of the regular curricula can be rearranged to cover five instead of four years.

COMBINATION CURRICULA

It is also possible to arrange combination curricula leading to two degrees in five or more years. (See page 16)

GRADUATE COURSES

Advanced courses in various engineering subjects are offered, by the Departments of the College of Engineering, to those who wish to pursue them. If such courses are pursued with the expectation of receiving credit upon them to apply towards any higher degree, the student must register in the Graduate School, under whose jurisdiction all work for the higher degrees is conducted. For further information, consult the bulletin of the Graduate School of the University or confer with the Dean or Secretary.

TWO-YEAR CURRICULA

The following two-year or short curricula, do not lead to a degree, but students completing them are furnished a formal certificate stating the work they have accomplished:

Clay-working
Industrial Arts
Mining

A two-weeks course in Highway Engineering similar to the one described on pages 20 to 24 will be given probably in 1916.

ADMISSION

The college is open on equal terms to both sexes. Applicants for admission must be at least seventeen years of age.

THE ENTRANCE BOARD

The admission of students to the University is in charge of the Entrance Board, which determines the credit that shall be issued on all entrance examinations and certificates, and furnishes all desired information to applicants. Correspondence relating to admission should be addressed to the Secretary of the Entrance Board, Ohio State University, Columbus, Ohio.

REQUIREMENTS

To obtain full standing in the College of Engineering, applicants under twenty-one years of age must have credit by examination or certificate for fifteen units. Of these fifteen units, not less than three shall be in English; three in mathematics (including solid geometry); one in physics; four in languages (other than English); and four shall be elective, and may include any subject given by any first-grade high school.

The requirements for admission to the College of Engineering are stated in detail in the *Bulletin of General Information.*

For admission **by examination** see page 27; **by certificate** see page 28 of the *Bulletin of General Information.*

Admission to Short Courses

Applicants must be at least seventeen years of age and unless they are over twenty-one years of age must have credit by examination or certificate for the common branches. In addition, each applicant under twenty-one years of age must present a letter or certificate showing that he has at least two years' consecutive practical experience in some industry related to the course which he wishes to pursue, and this certificate must be satisfactory to the Executive Committee of the College of Engineering.

CURRICULA

OUTLINE OF THE FIRST YEAR'S WORK OF ALL FOUR-YEAR CURRICULA

In order to permit all engineering students to have a year in which to find out definitely what courses they desire to pursue, the first year of all engineering curricula is made uniform. While students are asked to indicate their choice on entering the College, they can change at the end of the first year without any inconvenience.

Note—The figure in parenthesis following the name of each study indicates the number of the study in its department; the other figure indicates the number of credit hours.

First Semester		Second Semester	
Mathematics (131) College Algebra and Trigonometry	5	Mathematics (132) Trigonometry and Analytics	5
Chemistry (105 or 109)* General Chemistry	4	Chemistry (106 or 110)* General Chemistry and Qualitative Analysis	4
Modern Language French, German or Spanish	4	Modern Language French, German or Spanish	4
English (101) Paragraph Writing	2	English (104) Paragraph Writing	2
Engineering Drawing (101) Elementary Mechanical	2	Engineering Drawing (102) Lettering and Projections	3
Military Drill	1	Military Drill	1
Physical Education	1	Physical Education	1

---

*Students presenting Chemistry as an entrance subject will take Chemistry 109 and 110. Students with no entrance credits in Chemistry will take Chemistry 105 and 106.

SUMMER SESSION

Shopwork is required in the Summer Session in all Engineering curricula except Architecture and Civil Engineering. In Electrical, Mechanical, and Mine Engineering, the shopwork courses (109) and (115) are required at the end of the first year. In Chemical Engineering, the same courses are required, but may be taken at the end of the first or second year. In Ceramic Engineering and in General Engineering, shopwork (107), (109), and (115) are offered and two of these must be taken at the end of the first year.

GENERAL ENGINEERING

FOR FIRST YEAR, SEE PAGE 7

SECOND YEAR

FIRST SEMESTER			SECOND SEMESTER		
Mathematics Calculus	(141)	5	Mathematics Calculus	(142)	5
Chemistry Quantitative Analysis	(119)	4	Chemistry Quantitative Analysis	(120)	4*
Physics	(113)	5	Physics	(114)	5
Engineering Drawing	(103)	3	Physics	(136)	4*
Military Drill		1	Engineering Drawing	(104)	3
			Military Drill		1

---

*Alternative Courses. One must be taken.

(1) In addition to the two years outlined above, the student shall obtain credit for 68 semester hours in order to complete the requirements for his degree.

(2) Of these 68 hours, 10 hours must be Mechanics 101 and 102, which shall ordinarily be completed during the third year.

(3) At least 20 hours shall be selected from technical engineering subjects, and 20 hours shall be selected from either technical engineering subjects or from those sciences fundamental to engineering which are included in the Bulletin of the College of Engineering. These subjects must be approved by the engineering department in which the student's principal work is done, and by the Secretary of the College of Engineering.

(4) The production of a thesis shall be optional with the student, subject to the approval of the department concerned.

(5) The remaining 18 hours shall be selected from any work of the University to which the student is eligible, subject to the approval of the Engineering Department having supervision over the last two years of the student's work.

ARCHITECTURE

FOR FIRST YEAR, SEE PAGE 7

SECOND YEAR

FIRST SEMESTER			SECOND SEMESTER		
Mathematics Calculus	(141)	5	Mathematics Calculus	(142)	5
Art Elementary Drawing	(131)	2	Art Elementary Drawing	(132)	2
Architecture History of Architecture	(101)	3	Architecture History of Architecture	(102)	3
Architecture Order Problems	(103)	2	Architecture Order Problems	(104)	5
Engineering Drawing Descriptive Geometry	(107)	3	Architecture Shades, Shadows, and Perspective	(124)	3
Physics General Physics	(111)	3			
Military Drill		1	Military Drill		1

SUMMER COURSE—Architecture (120), Architectural Practice, or an Architectural Problem. Four credit hours.

THIRD YEAR

FIRST SEMESTER			SECOND SEMESTER		
Mechanics Statics & Strength of Materials	(101)	5	Mechanics Strength of Materials	(104)	2
Art Advanced Drawing	(133)	2	Art Water Color	(136)	2
Architecture Design	(107)	5	Architecture Design	(108)	4
Architecture Decoration, etc.	(109)	3	Architecture Working Drawings	(110)	4
Architecture Architectural Composition......	(115)	2	Architecture Photography	(112)	2
			Civil Engineering Trusses	(124)	3

SUMMER COURSE—Architecture (121), Architectural Practice, or an Architectural Problem. Four credit hours.

FOURTH YEAR

FIRST SEMESTER			SECOND SEMESTER		
Architecture Design	(115)	4	Architecture Design	(114)	3
Architecture Plumbing	(117)	1	Architecture Professional Practice	(116)	4
Architecture Masonry	(119)	2	Civil Engineering Surveying	(128)	2
Architecture Fire Protection	(123)	2	Civil Engineering Cement and Concrete	(118)	3
Architecture Architectural Rendering	(125)	2	Architecture Thesis	(118)	5
Civil Engineering Tall Buildings	(125)	3			
Mechanical Engineering Materials of Construction	(123)	2			
Mechanical Engineering Heating and Ventilating	(121)	2			

CERAMIC ENGINEERING

FOR FIRST YEAR, SEE PAGE 7

SECOND YEAR

FIRST SEMESTER			SECOND SEMESTER		
Mathematics Calculus	(141)	5	Mathematics Calculus	(142)	5
Physics Mechanics and Heat	(111)	3	Physics Electricity, Light and Sound	(112)	3
Engineering Drawing Descriptive Geometry	(103)	3	Engineering Drawing Machine Sketching	(104)	3
Ceramic Engineering Ceramic Chemistry	(101)	4	Ceramic Engineering Laboratory	(102)	4
Ceramic Engineering Clays	(141)	3	Ceramic Engineering Clay Wares	(142)	3
Military Drill		1	Military Drill		1

THIRD YEAR

Mechanics Statics & Strength of Materials	(101)	5	Mechanics Strength of Materials	(104)	2
Chemistry Physical Chemistry	(157)	3	Chemistry Physical Chemistry	(158)	3
Mine Engineering Mine Surveying	(103)	4	Civil Engineering Trusses	(124)	3
Ceramic Engineering Drying and Burning	(143)	3	Ceramic Engineering Decoration of Clay Wares	(144)	3
Ceramic Engineering Calculations	(105)	2	Ceramic Engineering Phys. Chem. Measurements	(108)	3
Mine Engineering Mine Trip	(109)	1	Mechanical Engineering Mechanism and Design	(110)	3

FOURTH YEAR

Ceramic Engineering Laboratory	(111)	5	*Ceramic Engineering Laboratory	(112)	5
Ceramic Engineering Drawing	(113)	5	Ceramic Engineering Drawing	(114)	5
Geology General Geology	(165)	3	*Ceramic Engineering Cement Lectures	(118)	5
Metallurgy Fuel	(117)	2	Civil Engineering Cement and Concrete	(118)	3
Metallurgy Iron and Steel	(119)	2	Ceramic Engineering Thesis	(116)	4

---

*Alternative courses. One must be taken.

CHEMICAL ENGINEERING

FOR FIRST YEAR, SEE PAGE 7

SECOND YEAR

FIRST SEMESTER			SECOND SEMESTER		
Mathematics Calculus	(141)	5	Mathematics Calculus	(142)	5
Physics General Physics	(111)	3	Physics General Physics	(112)	3
Engineering Drawing Descriptive Geometry	(103)	3	Engineering Drawing Machine Sketching	(104)	3
Chemistry Quantitative Analysis	(119)	4	Chemistry Quantitative Analysis	(120)	4
Chemistry Advanced General Chemistry	(113)	2	Chemistry Advanced General Chemistry	(114)	2
			Chemistry Chemical Problems	(124)	1
Military Drill		1	Military Drill		1

THIRD YEAR

Mechanics Statics & Strength of Materials	(101)	5	Mechanics Kinetics and Hydraulics	(102)	5
Engineering Drawing Technical Drawing	(121)	2	Engineering Drawing Technical Drawing	(122)	2
Metallurgy Fuel	(117)	2	Mineralogy Mineralogy and Crystallography	(102)	3
Metallurgy Iron and Steel	(119)	2	Chemistry Organic Chemistry, lecture	(152)	2
Chemistry Organic Chemistry, lecture	(151)	2	Electives (See foot note.)	5 to	7
Chemistry Organic Chemistry, laboratory	(153)	2			
Mechanical Engineering Steam Power Plants	(103)	3			

FOURTH YEAR

Mechanical Engineering Machine Design	(127)	5	Mechanical Engineering Machine Design	(144)	5
Chemistry Physical Chemistry	(157)	3	Chemistry Physical Chemistry	(158)	3
Chemistry Industrial Chemistry	(177)	2	Chemistry Industrial Chemistry	(178)	1
Chemistry Industrial Chemistry, laboratory	(185)	2	Chemistry Industrial Chemistry, laboratory	(186)	3
Electrical Engineering Elementary Electrical Engineering	(101)	5	Chemistry Thesis	(140)	4
			Chemistry Inspection Trip	(182 or 184)	1
			Elective		2

Electives in third year, second semester, must be chosen from the following courses, subject to approval of the departments concerned: Chemistry (136) 2, Chemical Literature; Chemistry (154) 2 or 3, Advanced Organic Chemistry; Chemistry (168) 3 to 5, Advanced Qualitative Analysis; Chemistry (176) 3, Sanitary Analysis; Chemistry (188) 2 or 3, Inorganic Preparations; Chemistry (192) 2, Rare Elements; (given only in odd numbered years); Metallurgy (110) 4, General Metallurgy; Metallurgy (112) 2, Calorimetry and Mine Gas Analysis.

CIVIL ENGINEERING

FOR FIRST YEAR, SEE PAGE 7

SECOND YEAR

FIRST SEMESTER		SECOND SEMESTER	
Mathematics (141) Calculus	5	Mathematics (142) Calculus	5
Physics (111) General Physics	3	Physics (112) General Physics	3
Engineering Drawing (105) Descriptive Geometry	3	Engineering Drawing (106) Advanced Descriptive Geom.	3
Civil Eng. (101 and 101a) Land Surveying & Field Practice	4 and 1	Civil Eng. (102 and 102a) R. R. Surveying & Field Practice	3 and 1
Civil Engineering (103) Topographic Drawing	2	Geology (168) General Geology	3
Military Drill	1	Military Drill	1

SUMMER COURSES—Civil Engineering (104 and 111), each four weeks of six days per week. Four credit hours for each course Field work in Surveying. Required in second and third years respectively.

THIRD YEAR

Astronomy (104) Geodesy & Least Squares	3	Astronomy (105) Geodesy and Least Squares	3
Mechanics (101) Statics & Strength of Materials	5	Mechanics (102) Kinetics and Hydraulics	5
Civil Engineering (105) Topographic Surveying	3	Civil Engineering (108) Timber Construction	3
Civil Engineering (107) Stereotomy	3	Civil Engineering (106) Roads and Streets	3
Civil Engineering. (109) Sanitary Engineering	2	Civil Engineering (110) Stresses in Structure	4
Architecture (111) Photography	2		

FOURTH YEAR

Civil Engineering (113) Bridge Design	4	*Civil Engineering (114) Advanced Bridges	4
Civil Engineering (118) Cement and Concrete	3	*Civil Engineering (112) Railways	4
Civil Engineering (115) Masonry Construction	3	Civil Engineering (116) Masonry Structure	3
Electrical Engineering (103)	3	Civil Engineering (117) Water Supply	3
Mechanical Engineering (173) Laboratory	5	Civil Engineering (120) Contracts and Specifications	2
Civil Engineering (119) Thesis	1	Mechanical Engineering (140) Mechanism and Mach. Design	2
		Civil Engineering (122) Thesis	4

---

*Alternative Course. One must be taken.

ELECTRICAL ENGINEERING

FOR FIRST YEAR, SEE PAGE 7

SECOND YEAR

FIRST SEMESTER			SECOND SEMESTER		
Mathematics Calculus	(141)	5	Mathematics Calculus	(142)	5
Physics Mechanics and Heat	(113)	5	Physics Electricity, Light and Sound	(114)	5
Engineering Drawing Descriptive Geometry	(103)	3	Physics Laboratory	(134)	3
Physics Laboratory	(133)	2	Engineering Drawing Machine Sketching	(110)	2
Shopwork Machine Work	(119)	3	Shopwork Advanced Machine Work	(122)	3
Military Drill		1	Military Drill		1

THIRD YEAR

Mechanics Statics & Strength of Materials	(101)	5	Mechanics Kinetics and Hydraulics	(102)	5
Physics Laboratory	(135)	5	Electrical Engineering D. C. Machinery	(104)	5
Mechanical Engineering Steam Power Plants	(103)	3	Mechanical Engineering Steam Engines	(118)	3
Mechanical Engineering Mechanism	(101)	3	Mechanical Engineering Laboratory	(160)	2
Engineering Drawing Technical	(111)	2	Electrical Engineering Applications, A. C. Prin.	(106 & 108)	3
Electrical Engineering Inspection Trip	(131)				

FOURTH YEAR

Mechanical Engineering Laboratory	(175)	3	Electrical Engineering A. C. Laboratory	(112)	3
Electrical Engineering A. C. Laboratory	(111)	3	Electrical Engineering Transmission	(124)	3
Electrical Engineering A. C. Machinery	(109)	3	Industrial Arts Machine Design	(112)	2
Electrical Engineering Elec. Machine Design	(121)	3	Electrical Engineering Thesis	(128)	5
Electrical Engineering Thesis	(127)	1	Electrical Eng'ring Inspection Trip	(130) or (134)	
Electrical Engineering	(*)	2			
Elective		2 to 4	Elective		2 to 5

---

*One of the following: (113) Railways, (115) Telephones, (117) Illumination, (119) Wireless Telegraphy.

MECHANICAL ENGINEERING

FOR FIRST YEAR, SEE PAGE 7

SECOND YEAR

FIRST SEMESTER		SECOND SEMESTER	
Mathematics (141) Calculus	5	Mathematics (142) Calculus	5
Physics (113) Mechanics and Heat	5	Physics (112) Electricity and Light	3
Engineering Drawing (103) Descriptive Geometry	3	Engineering Drawing (104) Machine Sketching	3
Shopwork (105) Foundry	2	Shopwork (120) Machine work	3
Shopwork (107) Chipping and Filing	2	Physics (138) Laboratory	2
Shopwork (111) Advanced Pattern Making	1	Civil Engineering (128) Surveying	2
Military Drill	1	Military Drill	1

THIRD YEAR

Mechanics (101) Statics & Strength of Materials	5	Mechanics (102) Kinetics and Hydraulics	5
Engineering Drawing (111) Technical Drawing	2	Architecture (112) Photography	2
Metallurgy (117) Fuel	2	Civil Engineering (126) Timber and Masonry	2
Metallurgy (119) Iron and Steel	2	Mech. Eng. (114) and (116) 3 and Mechanism and Drawing	1
Mathematics (151) Differential Equations	1	Mech. Eng. (118) and (120) 3 and Steam Engines and Boilers	1
Shopwork (121) Advanced Machine Work	3	Mechanical Engineering (164) Laboratory	2
Mechanical Engineering (103) Steam Power Plants	3		

FOURTH YEAR

Civil Engineering (123) Trusses	3	*Industrial Arts (114) Shop Buildings	2
Electrical Engineering (101) Elementary Elec. Engineering	5	*Mechanical Engineering (146) Steam Turbines	2
Mechanical Engineering (127) Machine Design	5	Mechanical Engineering (144) Machine Design	5
Mechanical Engineering (125) Gas Engines and Producers	2	Mechanical Engineering (142) Hydraulic Machinery	2
Mechanical Engineering (129) Thermodynamics	2	Mechanical Engineering (190) Laboratory	6
Mechanical Engineering (179) Laboratory	2	Mechanical Engineering (148) Thesis	
		Mechanical Engineering (130 or 134) Inspection Trip	

---

*Alternative Courses. One must be taken.

MINE ENGINEERING

FOR FIRST YEAR, SEE PAGE 7

SECOND YEAR

FIRST SEMESTER			SECOND SEMESTER		
Mathematics Calculus	(141)	5	Mathematics Calculus	(142)	5
Physics General Physics	(111)	3	Physics General Physics	(112)	3
Engineering Drawing Descriptive Geometry	(103)	3	Engineering Drawing Machine Sketching	(104)	3
Chemistry Quantitative Analysis	(119)	3	Metallurgy Laboratory	(106)	4
Mine Engineering Mine Surveying	(103)	4	Mineralogy Mineralogy and Crystallography	(102)	3
			Mine Engineering Mine Trip	(110)	1
Military Drill		1	Military Drill		1

THIRD YEAR

Mechanics Statics & Strength of Materials	(101)	5	Mechanics Kinetics and Hydraulics	(102)	5
Metallurgy Fuel	(117)	2	Metallurgy General Metallurgy	(110)	4
Metallurgy Iron and Steel	(119)	2	Metallurgy Calorimetry, Mine Gas Analysis	(112)	2
Metallurgy Fire Assaying	(105)	3	Mineralogy Determinative Mineralogy	(104)	3
Metallurgy Laboratory	(107)	4	Geology Petrography	(166)	2
Geology General Geology	(165)	3	Civil Engineering Trusses	(124)	3

FOURTH YEAR

Mine Engineering General Mining	(105)	5	Mine Engineering General Mining	(106)	5
Metallurgy Metallurgical Construction	(111)	1	Mine Engineering Plans and Specifications	(104)	4
Metallurgy Ore Dressing	(113)	2	Metallurgy Metallography, etc.	(114)	3
Mine Engineering Metallurgical Design	(111)	1	Mechanical Engineering Laboratory	(192)	3
Electrical Engineering	(103)	3	*Mine Engineering Thesis	(116)	3
Geology Economic Geology	(167)	3	*Metallurgy Thesis	(116)	
Architecture Photography	(111)	2			

---

*Alternative courses. One must be taken.

COMBINATION CURRICULA

Combination curricula leading to two engineering degrees, can be arranged for any two of the foregoing degrees. The amount of additional time will be at least thirty semester hours in excess of that required for one, and may be more. In no case will the student be required to take all of the work not common to the two curricula as published.

For instance a joint curriculum, Mechanical and Electrical Engineering, can be taken in five years. Where the curricula are more diverse, such as Civil Engineering and Mechanical Engineering, six years will be required.

ARTS-ENGINEERING CURRICULA

For the benefit of those who desire to possess the advantage of a wider general culture and a broader foundation than can be given in the limits of a four-year professional curriculum a combination of three years in the College of Arts, Philosophy and Science and three years in the College of Engineering can be so adjusted as to enable the student to secure the degree of Bachelor of Arts and the appropriate engineering degree.

The College of Engineering desires to establish similar relations with other educational institutions of approved standing in Ohio and elsewhere, by which a student can earn two degrees in five or six years.

GRADUATE WORK

The Graduate School has administrative control of the graduate work in all of the colleges of the University. The conditions under which advanced degrees can be obtained by graduates of the College of Engineering are as follows:

Master's Degree. The degree which will usually be conferred upon candidates whose major work lies in Engineering, will be that of Master of Science, (M. Sc.). The course of study will consist of one major and either one or two minors, at least one of the minors being in a different department from that in which the major is taken. A residence of one year devoted wholly to graduate work is required, but graduates of this University may complete not more than half of the required work at another institution offering equivalent opportunities for study. Except in certain special cases, a satisfactory thesis is required.

Professional Engineering Degrees. Upon nomination by the Faculty of the College of Engineering, the appropriate professional engineering degree of Ceramic Engineer, Chemical Engineer, Civil Engineer, Electrical Engineer, Engineer of Mines, Mechanical Engineer, or Master of Architecture, may be granted to graduates of this University upon any one of the following plans:

First. Four years of acceptable professional experience and an approved thesis.

Second. A Master of Science degree from this University with a major in engineering, followed by two years of acceptable professional experience and an approved thesis.

Third. One year of acceptable professional experience, followed by one year of approved study at this University, with an appropriate engineering major, and an approved thesis.

CURRICULA NOT LEADING TO A DEGREE

The following short curricula of two years each, are offered by the College of Engineering to meet the needs of that class of young men who have for some reason failed to qualify themselves to enter the regular four-year curricula, but whose experience in engineering work has shown them the need of some technical education as a requisite to further progress. These curricula are in no sense a substitute for the regular four-year curricula nor are they designed as preparation for subsequent entrance into the regular curricula. They aim to give an introduction to the fundamentals of engineering only, and in the shortest time consistent with any real educational result.

Applicants for admission to these curricula are required to have at least two years of consecutive practical experience in some branch of the industries related to the one they wish to pursue, and to present a satisfactory certificate to that effect. (See page 36 **General Information Bulletin.**)

TWO-YEAR CURRICULA

CLAYWORKING

FIRST YEAR

First Semester		Second Semester	
Mathematics (101) Elementary Algebra	5	Mathematics (102) Elementary Algebra	5
Chemistry (101) Elementary Chemistry	4	Chemistry (102) Elementary Chemistry and Qualitative Analysis	4
Engineering Drawing (113) Freehand and Lettering	4	Engineering Drawing (114) Mechanical Drawing	3
Ceramic Engineering (141) Occurrence and Winning of Clays	3	Ceramic Engineering (142) Preparation and Forming of Clay Wares	3
Military Drill	1	Military Drill	1
Physical Education	1	Physical Education	1

SUMMER SESSION—*Students are required to take two of the following subjects: Shopwork (107), (109), and (115), during the Summer Sesssion at the close of the first year.

SECOND YEAR

Ceramic Engineering (101) Ceramic Chemistry	4	Ceramic Engineering (102) Ceramic Chemistry	3
Ceramic Engineering (143) Drying & Burning of Clay Wares	5	Ceramic Engineering (144) Glazing and Decorating of Clay Wares	3
Ceramic Engineering (105) Calculations	2	Ceramic Engineering (126) Laboratory	5
Ceramic Engineering (115) Laboratory	2	Ceramic Engineering (122) Dryer and Kiln Design	4
Physics (101) Elementary Physics	6		
Military Drill	1	Military Drill	1

---

*Upon presentation of reasons satisfactory to the head of the department students may substitute work in a ceramic factory for the above shopwork courses.

INDUSTRIAL ARTS

FIRST YEAR

FIRST SEMESTER			SECOND SEMESTER		
Mathematics Elementary Algebra	(101)	5	Mathematics Elementary Algebra	(102)	5
Mathematics Plane and Solid Geometry	(113)	5	Mathematics Solid Geometry, Trigonometry	(114)	5
Engineering Drawing Freehand and Lettering	(113)	4	Engineering Drawing Mechanical Drawing	(114)	3
Shopwork Pattern Making	(109)	2	Shopwork Advanced Pattern Making	(112)	1
Shopwork Forging	(115)	2	Shopwork Foundry	(106)	2
			Shopwork Chipping and Filing	(108)	2
Military Drill		1	Military Drill		1
Physical Education		1	Physical Education		1

SECOND YEAR

Engineering Drawing Descriptive Geometry	(103)	3	Engineering Drawing Machine Sketching	(104)	3
Chemistry Elementary Chemistry	(101)	4	Chemistry Elementary Chemistry	(102)	4
Physics Elementary Physics	(101)	6	Industrial Arts Machines	(101)	3
Shopwork Machine work	(119)	3	Industrial Arts Designing	(103)	1
Military Drill		1	Shopwork Advanced Machine Work	(122)	3
			Shopwork Advanced Pattern Making	(130)	3
			Military Drill		1

MINING

FIRST YEAR

FIRST SEMESTER		SECOND SEMESTER	
Mathematics (101) Elementary Algebra	5	Mathematics (102) Elementary Algebra	5
Mathematics (113) Plane and Solid Geometry	5	Mathematics (114) Solid Geometry, Trigonometry	5
Physics (101) Elementary Physics	6	Shopwork (116) Forging	2
		Geology (162) Elementary Physiography	4
Military Drill	1	Military Drill	1
Physical Education	1	Physical Education	1

SECOND YEAR

Engineering Drawing (113) Freehand and Lettering	4	Engineering Drawing (114) Mechanical Drawing	3
Chemistry (101) Elementary Chemistry	4	Geology (164) Elementary Geology	3
Mine Engineering (107) Mine Plans	2	Metallurgy (102) Water Supply and Mine Gases	4
Mine Engineering (101) Mine Surveying	5	Mine Engineering (102) General Mining	5
Military Drill	1	Military Drill	1

HIGHWAY ENGINEERING

A two-weeks program of lectures in Highway Engineering has been given at the University for the past three years. If appropriations can be secured this work will be continued.

This work in Highway Engineering is designed to meet the needs of County Surveyors, County Commissioners, Township Trustees, and Road-drag Superintendents, State Highway Inspectors, and all who are interested in knowing more of good road construction and wish to get some connected and systematic knowledge of the present status of highway engineering.

It was not designed to create highway engineers, but to try to bring home to the people the necessity of using trained and educated highway engineers, if the best results are to be obtained from the expenditures being made for highways.

Program of Lectures as Given in 1915

MONDAY, JANUARY 25

Address of Welcome.......... ....President W. O. Thompson

"The National Old Trails Road and the Advantages of Good Roads"..Judge J. M. Lowe

"The Work of Reconstructing the Old National Pike"..... ....Mr. R. N. Waid

TUESDAY, JANUARY 26—EARTH ROADS DAY

"Location of Roads in Hilly Country"... .....Mr. W. C. Fawcette

"The Drainage and Grading of Earth Roads"....Mr. W. C. Fawcette

"Earth and Sand Clay Roads in the South."........Mr. J. W. Ducey

"The Road Drag—Its Use"......................Mr. A. H. Hinkle

"Some Earth Roads and Their Improvement"................. .... Ohio State Highway Department

WEDNESDAY, JANUARY 27—GRAVEL ROAD DAY

"Alignment and Grades for all Kinds of Roads"....Mr. R. K. Schlafly

Convocation..............................Chapel, University Hall

Visit to the University Library................ ....Leader, Mr. Charles Reeder, Reference Librarian

"Common Road Materials of Ohio"........Professor C. E. Sherman

"Construction and Maintenance of Gravel Roads"...Mr. A. H. Hinkle

THURSDAY, JANUARY 28—ROAD ECONOMICS

"Fundamental Principles in Good Road Economics"........ .... Mr. J. E. Pennybacher

"Some Causes for the Poor Roads and Pavements in America"... ....Professor Leonard S. Smith

"The Work of the Ohio State Highway Commission"......... .... Hon. James R. Marker

"Highway Organization"......................Mr. Frank D. Lyon

"The Planning and Replanning of City Streets and Suburbs with Reference to Artistic Values and Ease of Transportation" ... .Professor Leonard S. Smith

FRIDAY, JANUARY 29—MACADAM DAY

"The Construction of Water Bound Macadam"....Mr. Frank D. Lyon

"Methods of Maintaining Macadam Roads"....Mr. John W. Graham

"The Testing of Road Materials"..................Mr. Abel S. Rea
Visit to the Road Laboratory

SATURDAY, JANUARY 30

Inspection trip to the State Experimental Roads and the City Streets, if the weather permits, or a visit to the Storage Dam and Water Purification Plant or other city plants, as those in attendance may vote.

MONDAY, FEBRUARY 1—CONCRETE DAY

"Proportioning and Economic Handling of Concrete Materials".. ....Mr. K. H. Talbot

"Concrete Roads—Plain and Carpeted".......Mr. Frank F. Rogers

"Testing Cement and Sands"............Professor W. S. Hindman
Visit to Cement and Concrete Laboratory

"Concrete Road and Pavement Construction, Illustrated"..Mr. Shaw

TUESDAY, FEBRUARY 2—BRICK DAY

"Efficiency of the Engineer in Relation to Vitrified Brick Road Construction. The Manufacture of Vitrified Brick, Quality and Uses"..................................Mr. Wm. P. Blair

"Necessary Preparation for Brick Pavements for Highways"..... ....Mr. W. C. Perkins

"The Importance of Details in Vitrified Brick Road Construction" ....Mr. Wm. P. Blair

"General Discussion of Brick Roads"

WEDNESDAY, FEBRUARY 3—ASPHALT DAY

"An Engineer's Knowledge of Bituminous Materials and Their Use. How may he get the Knowledge?" ....Mr. T. Hugh Boorman

Convocation........................The Chapel, University Hall

"Asphaltic Macadam and Various Bituminous Road Surfaces—Their Proper Construction and Maintenance"............... .... Mr. T. Hugh Boorman

"Asphalt Plants for Street and Block Street Work—Their Construction and Operation"...................Mr. Francis P. Smith

"Construction and Maintenance of Asphalt Streets, With a Discussion of Traffic Conditions for which they are Fitted"....... ....Mr. Clarence D. Pollock

"The Asphalt Industry from the Lake to the Road"............. ....The Barber Asphalt Paving Company

THURSDAY, FEBRUARY 4—BRIDGE AND CULVERT DAY

The Selection of Bridge and Culvert Openings"............. .... Mr. John R. Chamberlin

"Concrete Bridge Details"....................Mr. Wilbur J. Watson

"Culverts and Bridges"........................Mr. A. A. Henderson

"General Discussion"

FRIDAY, FEBRUARY 5—MACHINERY DAY AND MISCELLANEOUS

"The Economic use of the Steam Shovel in Road Excavation" ....Mr. A. F. King

"Machinery and its Use in the Construction of Bituminous .... Surfaced Roads"........................ Mr. Philip P. Sharples

"Macadam Road Machinery, Drilling and Crushing"...Mr. L. F. Kling

"The Economic Use of Road Machinery"....... Mr. S. H. Chauvenet

"Brick Making and Brick Road Construction"......Mr. F. L. Hopley

SATURDAY, FEBRUARY 6

Inspection Trip. Weather permitting, Street Inspection or Visit to Municipal plants.

DEPARTMENTS OF INSTRUCTION

ARCHITECTURE

Office 100, Brown Hall

PROFESSORS BRADFORD, CHUBB,
MR. HASKETT, MR. RONAN

101. History of Architecture. Three credit hours. First semester. Architecture, second year, Mr. Chubb.

Lectures, illustrated by lantern slides.

102. Continuation of 101. Three credit hours. Second semester. Architecture, second year, Mr. Chubb.

103. Order Problems. Two credit hours. First semester. Architecture, second year. Prerequisite, Engineering Drawing 102, concurrent with Engineering Drawing 107. Mr. Ronan.

104. Order Problems. Five credit hours. Second semester. Architecture, second year. Prerequisite, Architecture 103. Mr. Ronan.

107. Design. Five credit hours. First semester. Lectures and practice. Architecture, third year. Prerequisite, Architecture 104, and concurrent with Architecture 113. Mr. Ronan.

108. Design. Four credit hours. Second semester. Architecture, third year. Prerequisite, Architecture 107. Mr. Chubb.

109. Decoration and Ornament. Three credit hours. First semester. Architecture, third year. Prerequisite, Architecture 104 and Art 131. Mr. Chubb.

110. Working Drawings. Four credit hours. Second semester. Architecture, third year. Prerequisite, Architecture 107. Mr. Chubb, Mr. Ronan.

111. Photography. Two credit hours. First semester. Civil Engineering, third year; Mine Engineering, fourth year. Prerequisite, Chemistry 105, 106, or 109, 110. Mr. Haskett.

112. Photography. Two credit hours. Second semester. Mechanical Engineering and Architecture, third year. Prerequisite, Chemistry 105, 106, or 109, 110. Mr. Haskett.

113. Principles of Architectural Composition. Two credit hours. First semester. Architecture, third year. Prerequisite, Architecture 102. Mr. Chubb.

114. Designing. Three credit hours. Second semester. Architecture, fourth year. Prerequisite, Architecture 108. Mr. Chubb, Mr. Ronan.

115. Designing. Four credit hours. First semester. Architecture, fourth year. Prerequisite, Architecture 108. Mr. Chubb.

116. Professional Practice. Four credit hours. Second semester. Architecture, fourth year. Prerequisite, Architecture 115. Mr. Bradford.

117. Sanitary Plumbing. One credit hour. First semester. Architecture, fourth year. Mr. Bradford.

118. Thesis. Five credit hours. Second semester. Architecture, fourth year. Mr. Bradford, Mr. Chubb, Mr. Ronan.

119. Masonry. Two credit hours. First semester. Architecture, fourth year. Prerequisite, Architecture 110. Mr. Bradford.

120. Summer Work. Four credit hours. The equivalent of four weeks of work in an architect's office, or a problem in design assigned by the department. Between the second and third years.

121. Summer Work. Four credit hours. The equivalent of four weeks of work in an architect's office, or a problem in design assigned by the department. Between the third and fourth years.

122. Photography. Two credit hours. Second semester. Prerequisite, Architecture, 111 or 112. Mr. Haskett.

123. Fire Protection. Two credit hours. First semester. Archi. tecture, fourth year. Concurrent Civil Engineering 125. Mr. Chubb-

124. Shades, Shadows, and Perspective. Three credit hours.

Second semester. Architecture, second year. Prerequisite, Engineering Drawing 107. Mr. Ronan.

125. Architectural Rendering. Two credit hours. First semester. Architecture, fourth year. Prerequisite, Art 136. Mr. Chubb.

For Graduate courses in this department see the Bulletin of the Graduate School.

ART

Office 203, Hayes Hall

ASSISTANT PROFESSOR KELLEY, MISS ROBISON, MISS SHEPHERD, MR. NORRIS

131-132. Elementary Drawing. Two credit hours. The year. Four laboratory hours per week. Architecture, second year.

This course is designed to develop a knowledge of form and values in black and white, also the use of free-hand perspective.

133. Advanced Drawing. Two credit hours. First semester. Four laboratory hours per week. Architecture, third year. Prerequisite, Art 131-132.

This course is designed to give the student some freedom in the use of drawing as a medium of expression. Drawing from the antique and the costume model.

136. Water Color. Two credit hours. Second semester. Four laboratory hours per week. Architecture, third year. Prerequisite, Art 133.

Painting from still life and costume model. The purpose of this course is to train the color perceptions of the student.

ASTRONOMY

Office, Emerson McMillin Observatory

PROFESSOR LORD, ASSOCIATE PROFESSOR MANSON

104. Astronomy, Geodesy, and Least Squares. Three credit hours. First semester. Civil Engineering, third year. Prerequisite, the calculus. Mr. Lord, Mr. Manson.

105. Continuation of 104. Three credit hours. Second semester. Civil Engineering, third year. Mr. Lord, Mr. Manson.

For Graduate courses in this department see the Bulletin of the Graduate School.

CERAMIC ENGINEERING

Office 131, Lord Hall

PROFESSORS ORTON, WATTS, ASSISTANT PROFESSOR HARROP, MR. LYSATT

101. Ceramic Chemistry. Four credit hours. First semester. Ceramic Engineering and Short Clayworking, second year. Prerequisite, Chemistry 106 or 110. Mr. Demorest.

Quantitative analysis of limestone and simple minerals.

102. Ceramic Chemistry. Four credit hours. Second semester. Ceramic Engineering, second year. Prerequisite, Ceramic Engineering 101. Mr. Demorest.

Quantitative analysis of clays, fire-gases, etc.

105. Ceramic Calculations. Two credit hours. First semester. Ceramic Engineering, third year; Short Clayworking, second year. Prerequisite, Ceramics 101. Mr. Harrop.

Calculations involved in blending of ingredients used in ceramic mixtures; determinations of limits of variation in given series; limits of errors; volume calculations; problems in heat.

108. Physical and Chemical Measurements of Clays. Three credit hours. Second semester. Ceramic Engineering, third year. Mr. Watts.

Application of physical chemical laws to fusions of mineral mixtures; determination of melting points; deformation periods; relative viscosity of fused magmas; study of influence of salts on viscosity of slips; etc.

111. Laboratory Work in Ceramics. Five credit hours. First semester. Ceramic Engineering, fourth year. Prerequisite, Ceramics 108 and 144. Mr. Watts.

Practice in clay testing and measurement of physical properties of clays; the production of bodies made from single clays and of clays with minerals. In each case the bodies are burned and tested.

112. Continuation of 111. Five credits hours. Second semester. Ceramic Engineering, fourth year. Prerequisite, Ceramics 111. Mr. Watts.

The production of slips, engobes, and glazes, and the study of the methods of coloring.

113. Ceramic Designing. Five credit hours. First semester. Ceramic Engineering, fourth year. Prerequisite, Ceramics 144. Mr. Harrop.

Designing, estimating cost of, and writing specifications for kilns and dryers.

114. Continuation of 113. Five credit hours. Second semester. Ceramic Engineering, fourth year. Prerequisite, Ceramics 113. Mr. Harrop.

The work started in Ceramics 113 is extended to the design and equipment of clay-working plants.

115. Laboratory Work in Ceramics. Two credit hours. First semester. Short Clayworking, second year. Concurrent, Ceramics 143. Mr. Watts.

Testing of clays and minerals employed in clay manufacture and in blending of same for ceramic purposes.

116. Thesis. Four credit hours. Second semester. Ceramic Engineering, fourth year.

118. Cement Manufacture. Five credit hours. Second semester. Alternative with Ceramics 112, Ceramic Engineering, fourth year. Prerequisites, Ceramics 102 and 144. Mr. Harrop.

The theory of hydraulicity, the compounding, manufacture, and testing of natural and Portland cements and other hydraulic bodies.

122. Dryer and Kiln Design. Four credit hours. Second semester. Short Clayworking, second year. Prerequisite with Ceramics 105. Mr. Harrop.

A graphic study of dryer and kiln design.

126. Laboratory Work in Ceramics. Five credit hours. Second semester. Short Clayworking, second year. Prerequisite, Ceramics 115. Mr. Watts.

The preparation of slips, engobes, and glazes, and the study of the methods of coloring.

141. Ceramic Lectures. Three credit hours. First semester. Ceramic Engineering, second year, Short Clayworking, first year. Mr. Orton, Mr. Harrop.

Origin of clays, constitution, properties, and winning of Ceramic materials.

142. Continuation of 141. Three credit hours. Second semester. Ceramic Engineering, second year; Short Clayworking, first year. Mr. Orton, Mr. Harrop.

General principles of the preparation and forming of clay wares.

143. Ceramic Manufacture. Three credit hours. First semester. Ceramic Engineering, third year; Short Clayworking, second year. Mr. Orton, Mr. Harrop.

The drying and burning of clay wares.

144. Continuation of 143. Three credit hours. Second semester. Ceramic Engineering, third year; Short Clayworking, second year. Mr. Orton, Mr. Watts.

Glazing and decoration of clay wares.

For Graduate courses in this department see the Bulletin of the Graduate School.

CHEMISTRY

Office 100, Chemistry Hall

PROFESSOR MCPHERSON, EMERITUS PROFESSOR NORTON, PROFESSORS HENDERSON, FOULK, EVANS, WITHROW, ASSISTANT PROFESSORS BOORD, SHIPLEY, MR. HUMMEL, AND DEPARTMENT ASSISTANTS

101. Elementary Chemistry. Four credit hours. First semester, one lecture, one quiz, six laboratory hours per week. Short Mining, second year; Short Clayworking, first year. Mr. Evans, Mr. Hummel, Mr. Day.

A general introductory course on the Chemistry of the non-metals. It is distinctly elementary in character and is arranged for students in short courses only. No credit is allowed for it in the regular four year courses. Students taking this course should follow with chemistry 102, second semester.

102. Elementary Chemistry and Qualitative Analysis. Four credit hours. Second semester. Continuation of Chemistry 101. Short Courses. Mr. Evans, Mr. Hummel, Mr. Day.

A general introductory course on the chemistry of the metals. The laboratory work deals with the elementary principles of qualitative analysis. The course is arranged for students in short courses only. No credit is allowed for it in the regular four-year courses.

105. Elementary Chemistry. Four credit hours. Either semester. One lecture, one quiz, and six laboratory hours per week. Taken by first year students in all four-year courses who have not presented chemistry as an entrance credit. Mr. Evans, Mr. Hummel, Mr. McNeil, Mr. Parkinson.

A general course in the chemistry of non-metals.

106. Elementary Chemistry and Qualitative Analysis. Four credit hours. Either semester. A continuation of Chemistry 105. Mr. Evans, Mr. Hummel, Mr. McNeil, Mr. Parkinson.

A general course in the chemistry of the metals. The laboratory work is a general introductory course in qualitative analysis.

109. General Chemistry. Four credit hours. Either semester. One lecture, one quiz, and six laboratory hours per week. Taken by first year students in all four-year courses who have presented chemistry as an entrance credit. Mr. Evans, Mr. Hummel, Mr. McCrosky, Mr. Schmidt.

A general course on the chemistry of non-metals.

110. General Chemistry and Qualitative Analysis. Four credit hours. Second semester. A continuation of Chemistry 109. Mr. Evans, Mr. Hummel, Mr. McCrosky, Mr. Schmidt.

A general course in the chemistry of the metals. It is more advanced than Chemistry 106. The laboratory work is a general course in qualitative analysis.

113. Advanced General Chemistry. Two credit hours. First semester. Two lectures per week. Chemical Engineering, second year. Prerequisite, Chemistry 106 or 110. Mr. Henderson.

A course on the fundamental topics of general chemistry designed as a thorough review and extension of the first year courses.

114. Advanced General Chemistry. Two credit hours. Second semester. A continuation of Chemistry 113. Chemical Engineering, second year. Mr. Henderson.

117. Qualitative Analysis. Three credit hours. First semester. One lecture and six laboratory hours per week. Prerequisite, an acceptable course in general chemistry. Mr. Shipley.

119. Quantitative Analysis. (a) Three credit hours. First semester. One lecture and six laboratory hours per week. Mine Engineering, second year. (b) Four credit hours. First semester. One lecture and nine laboratory hours per week. Chemical Engineering, second year. Prerequisite, Chemistry 106 or 110. It is desirable that this course be accompanied by Chemistry 113. Mr. Foulk, Mr. Shipley.

The elementary principles of gravimetric and volumetric analysis.

120. Qualitative Analysis. Four credit hours. Second semester. One lecture and nine laboratory hours per week. Chemical Engineering, second year. Prerequisite, Chemistry 119. Mr. Foulk, Mr. Shipley.

A continuation of Chemistry 119 with typical analytical methods in gravimetric and volumetric analysis. This course should be accompanied by Chemistry 124. It is desirable that it be accompanied by Chemistry 114.

124. Chemical Problems. One credit hour. Second semester. Chemical Engineering, second year. Mr. Foulk.

Extended practice in the solution of problems pertaining to gravimetric and volumetric analysis. This course is arranged to accompany Chemistry 120.

136. The Reading of Chemical Literature. Two credit hours. Second semester. Chemical Engineering, elective, third year. Prerequisite, one year of German. Mr. Foulk.

The object of this course is to afford practice in the rapid reading of German chemical literature, the selections being made with special reference to the technical terms of the science.

140. Thesis. Four credit hours. Second semester. Chemical Engineering, fourth year. Mr. McPherson, Mr. Henderson, Mr. Withrow, Mr. Foulk, Mr. Evans.

151. Organic Chemistry. Two credit hours. First semester. Two lectures per week. Chemical Engineering, third year. Prerequisite, Chemistry 114 and 120. Mr. McPherson.

General course in organic chemistry.

152. Continuation of Chemistry 151. Two credit hours. Second semester. Two lectures per week. Chemical Engineering, third year. Prerequisite, Chemistry 151. Mr. McPherson.

153. Organic Chemistry. Two or three credit hours. First semester. Six or nine laboratory hours per week. Chemical Engineering, third year. Must be accompanied or preceded by Chemistry 151. Mr. McPherson, Mr. Boord.

A general course in the preparation of typical organic compounds.

154. Continuation of Chemistry 153. Two or three credit hours. Second semester. Six or nine laboratory hours per week. Chemical Engineering, elective, third year. Must be preceded or accompanied by Chemistry 152. Mr. McPherson, Mr. Boord.

157. Physical Chemistry. Three credit hours. First semester. Three lectures per week. Chemical Engineering, fourth year; Ceramic Engineering, third year. Prerequisite, Chemistry 114, 120, and 152. Mr. Henderson.

This is a general course in physical chemistry.

158. Physical Chemistry. Three credit hours. Second semester. Three lectures per week. Chemical Engineering, fourth year; Ceramic Engineering, third year. A continuation of Chemistry 157. Mr. Henderson.

162. Physical Chemistry. Two or three credit hours. Second semester. Six or nine laboratory hours per week. Elective. Prerequisite or concurrent, Chemistry 157. Mr. Henderson, Mr. Dickson.

A laboratory course designed to illustrate the general lecture course 157-158.

165. Quantitative Analysis. Advanced course. Two credit hours. First semester. Two recitations. Prerequisite, Chemistry 119-120, or equivalent. Mr. Foulk.

A general survey of the methods of quantitative analysis.

167. Special Methods of Analysis. Three to five credit hours. First semester. One lecture and six to twelve laboratory hours per week. Chemical Engineering, elective, third year. Prerequisite, Chemistry 119-120.

Selections may be made from gas analysis, microchemical analysis and spectrum analysis. Time to be arranged.

168. Qualitative Analysis. Three to five credit·hours. Second semester. One lecture, six to twelve laboratory hours per week. Chemical Engineering, elective, third year. Prerequisite, Chemistry 120, or equivalent. Mr. Shipley.

Advanced course. Extended work in general qualitative analysis including the more important of the rare elements.

169. Quantitative Analysis. Three to five credit hours. First semester. One conference and six to twelve laboratory hours per week. Prerequisite, Chemistry 119-120, or equivalent. Mr. Foulk.

Advanced course. A laboratory course in advanced quantitative analysis.

176. Sanitary Analysis. Three credit hours. Second semester. Two lectures and three laboratory hours per week. Chemical Engineering, elective, third year. Prerequisite, Chemistry 120, or equivalent. Mr. Foulk.

The methods of sanitary water analysis and interpretation of results.

177. Industrial Chemistry. Two credit hours. First semester Two lectures per week. Prerequisite, Chemistry 113-114 and 153. Mr. Withrow.

The principles underlying the application of chemistry to the problems of the industries.

178. Industrial Chemistry. One credit hour. Second semester. One lecture per week. Prerequisite, Chemistry 177. Mr. Withrow.

182. Industrial Inspection Trip. A six-day excursion at a suitable time in connection with Course 177-178 for the inspection of industrial chemical processes in actual operation. The entire expense is about $30. A satisfactory report on the work inspected is required. Mr. Withrow.

184. Written Reports. A course of assigned reading upon some industrial chemical process and a written report of the same. This is a substitute for Chemistry 182, but the substitution is only allowed upon presentation of reasons satisfactory to the instructor in charge. Mr. Withrow.

185. Industrial Chemistry. Two credit hours. One conference, five laboratory hours per week. Prerequisite, Chemistry 119-120. Prerequisite or concurrent, Chemistry 177. Mr. Withrow.

Industrial chemical research.

186. Industrial Chemistry. Three credit hours. One conference, and eight laboratory hours per week. Prerequisite, Chemistry 119-120. Prerequisite or concurrent, Chemistry 177-178. Mr. Withrow.

Industrial chemical research and technical analysis.

187. Inorganic Preparations. Two or three credit hours. The year. Six or nine laboratory hours per week. Chemical Engineering, elective, third year. Prerequisite, Chemistry 114. Mr. Henderson. Mr. Dickson.

The preparation of a limited number of compounds chosen so as to give practice in the different kinds of manipulation involved in the preparation of inorganic compounds.

***192. Rare Elements.** Two credit hours. Second semester. Two lectures per week, Elective. Given in 1914-15 and biennially thereafter. Prerequisite, Chemistry 114 and 120. Mr. Henderson.

The chemistry of the rare elements, including a discussion of their increasing economic importance.

194. Applied Electro-Chemistry. Two credit hours. Second semester. Two lectures per week. Elective. Prerequisite or concurrent, Chemistry 158, except by the special permission of the instructor. Mr. Withrow.

The application of the electric current in chemical industries.

For Graduate courses in this department see the Bulletin of the Graduate School.

CIVIL ENGINEERING

Office 107, Brown Hall

PROFESSORS SHERMAN, ENO, MORRIS, ASSISTANT PROFESSORS HINDMAN, SCHLESINGER, MR. SLOANE, MR. KILMER, MR. NEILSON

101. Land Surveying. Four credit hours. First semester. Four recitations per week. Civil Engineering, second year. Prerequisite, Mathematics 132, Engineering Drawing 102. Mr. Sherman, Mr. Eno, Mr. Schlesinger, Mr. Sloane, Mr. Kilmer.

Care and use of instruments. Farm, City and Hydrographic Surveying.

101a. Field Practice. One credit hour. First semester. Three hours per week in field. Civil Engineering, second year. Prerequisite, or concurrent, Civil Engineering 101. Mr. Schlesinger, Mr. Hindman, and department instructors.

Field exercises in use of instruments and surveying.

102. Railroad Surveying. Three credit hours. Second semester. Three recitations per week. Civil Engineering, second year. Prerequisites, Civil Engineering 101 and 101a. Mr. Sherman, Mr. Schlesinger, Mr. Sloane, Mr. Kilmer.

---

*Not given in 1915-1916.

Simple, compound, and transition curves, frogs, switches, and earthwork.

102a. Field Practice. One credit hour. Second semester. Three hours per week in field. Civil Engineering, second year. Prerequisite or concurrent Civil Engineering 102. Mr. Schlesinger, Mr. Sloane, and department instructors.

Field practice in laying out curves, frogs, switches, and earthwork.

103. Topographic Drawing. Two credit hours. First semester. Six hours per week in drafting room. Civil Engineering, second year. Prerequisite, Engineering Drawing 102. Mr. Sherman, Mr. Eno.

Exercises in black ink and color topographic drawing.

104. Summer Surveying Camp. Four credit hours. Civil Engineering, at close of second year. Prerequisite, Civil Engineering 101a and 102a.

Four weeks of six days per week of ten hours per day, from the middle of June to the middle of July.

105. Topographic Surveying. Three credit hours. First semester. Nine hours per week in field or drawing room. Civil Engineering, third year. Prerequisite, Civil Engineering 101, 102, and 104. Mr. Schlesinger, Mr. Sloane.

Field and office work in four or five kinds of topographic surveying.

106. Roads and Streets. Three credit hours. Second semester. Three recitations per week. Civil Engineering, third year. Prerequisite, Civil Engineering 102 and 104. Mr. Eno.

107. Stereotomy. Three credit hours. First semester. Recitations, lectures, and drawing. Civil Engineering, third year. Prerequisite, Engineering Drawing 106. Mr. Schlesinger, Mr. Sloane.

108. Timber Construction. Three credit hours. Second semester. Lectures and drawing. Civil Engineering, third year. Prerequisite, Engineering Drawing 105; concurrent, Mechanics 102. Mr. Schlesinger. Mr. Sloane.

109. Sanitary Engineering. Two credit hours. First semester. Two recitations per week. Civil Engineering, third year. Prerequisite Civil Engineering 102 and 104. Mr. Eno.

110. Stresses in Structure. Four credit hours. Second semester. Four recitations per week. Civil Engineering, third year. Prerequisite, or concurrent Mechanics 102. Mr. Morris.

111. Summer Surveying Camp. Four credit hours. Civil Engineering at close of third year. Prerequisite, Civil Engineering 104 and 105.

Four weeks of six days per week of ten hours per day, from the middle of June to the middle of July.

112. Railway Location. Four credit hours. Second semester. Four recitations per week. Optional with Civil Engineering 114. Civil Engineering, fourth year. Prerequisite, Civil Engineering 102 and 111 and Mechanics 102. Mr. Sherman.

113. Bridge Designing. Four credit hours. First semester. Four recitations per week. Civil Engineering, fourth year. Prerequisite, Civil Engineering 110. Mr. Morris.

114. Advanced Bridges. Four credit hours. Second semester. Four recitations per week. Optional with Civil Engineering 112. Civil Engineering, fourth year. Prerequisite, Civil Engineering 113. Mr. Morris.

115. Masonry Construction. Three credit hours. First semester. Three recitations per week. Civil Engineering, fourth year. Prerequisite, Civil Engineering 111, Mechanics 102. Mr. Sherman.

116. Masonry Structures. Three credit hours. Second semester. Three recitati on lecture, or drawing periods per week. Civil Engineering, fourth year. Prerequisite, Civil Engineering 115. Mr. Sherman.

117. Water Supply. Three credit hours. Second semester. Three recitations per week. Civil Engineering, fourth year, Prerequisite, Civil Engineering 111, Mechanics 102. Mr. Eno.

118. Cement and Concrete. Three credit hours. Either semester. Architecture, Ceramic and Civil Engineering, fourth year. Prerequisite, Mechanics 102 or 104. Mr. Hindman.

119. Thesis. One credit hour. First semester. Civil Engineering, fourth year. Prerequisite, Civil Engineering 110 and 111.

120. Contracts and Specifications. Two credit hours. Second semester. Two recitations or lectures per week. Civil Engineering, fourth year. Prerequisite, Civil Engineering 106, 109, and 115. Mr. Adams, Mr. Page. (College of Law.) Mr. Eno.

122. Thesis Four credit hours. Second semester. Civil Engineering, fourth year. Prerequisite, Civil Engineering 119.

124. Trusses. Three credit hours. Either semester. Lectures, recitations, and drawing. Mechanical Engineering, fourth year. Drawing the last three or four weeks. Prerequisite, Mechanics 102 or 104. Architecture, Ceramic and Mine Engineering, third year, Concurrent Mechanics 102 or 104. Mr. Hindman.

125. Tall Buildings. Three credit hours. First semester. Three lectures per week. Architecture, fourth year. Prerequisite, Civil Engineering 124. Mr. Morris.

126. Timber and Masonry. Two credit hours. Second semester. Two lectures or recitations per week. Mechanical Engineering, third year. Prerequisite, Mechanics 101. Mr. Schlesinger.

128. Plane Surveying. Two credit hours. Second semester. One lecture and one field exercise of three hours per week. Architecture, fourth year. Mechanical Engineering, second year. Prerequisite, Engineering Drawing 102, Mathematics 132. Mr. Neilson, Mr. Kilmer.

For Graduate courses in this department see the Bulletin of the Graduate School.

ELECTRICAL ENGINEERING

Office 171, Robinson Laboratory

PROFESSORS CALDWELL, FLOWERS, MR. SHEPARDSON
MR. BROWN, MR. FROST

101. Electrical Engineering. Five credit hours. First semester. Three lectures and four-hours laboratory per week. Chemical Engineering and Mechanical Engineering, fourth year. Prerequisite Physics 112 or Physics 114. Mr. Shepardson.

Lectures and laboratory work on direct and alternating current circuits, dynamo machinery, transformers, accumulators, and their applications.

103. Electrical Engineering. Three credit hours. First semester Two lectures and three laboratory hours per week. Civil and Mine Engineering, fourth year. Prerequisite, Physics 112 or 114. Mr. Flowers, Mr. Shepardson.

Lectures and laboratory work on direct current machinery, circuits, and transmission.

104. Direct Current Machinery. Five credit hours. Second semester. Three lectures and four laboratory hours per week. Electrical Engineering, third year. Prerequisites, Physics 135, Mathematics 142, and Mechanics 101. Mr. Flowers, Mr. Shepardson.

Generators and motors, a study of their theory, construction and operation. Lectures, recitations, problems, and laboratory.

106. Applications of Electricity. Three hours, for one-half semester. Second semester. Three lectures per week. Electrical Engineering, third year. Prerequisites, Physics 135 and Mathematics 142. Mr. Caldwell.

A brief treatment of the uses of electricity, in illumination, rail ways, mining, etc.

108. Alternating Current Circuits and Machinery. Three hours for one-half semester. First half of second semester. Electrical Engineering, third year. Prerequisites, Mathematics 142, Physics 135, Mechanics 101; concurrent, Electrical Engineering 104. Mr. Caldwell.

General principles, circuits, generators and transformers.

109. Alternating Current Machinery. Three credit hours. First semester. A continuation of Electrical Engineering 108. Three lectures per week. Electrical Engineering, fourth year. Prerequisite, Electrical Engineering 108; concurrent, Electrical Engineering 111. Mr. Caldwell.

Transformers, synchronous motors, induction motors, etc.

111. Alternating Current Laboratory. Three credit hours. First semester. Electrical Engineering, fourth year. Prerequisite, Electrical Engineering 108; concurrent, Electrical Engineering 109. Mr. Brown.

Alternating current apparatus and accumulators.

112. Advanced Alternating Current Laboratory. Three credit hours. Second semester. Electrical Engineering, fourth year. Prerequisite, Electrical Engineering 109 and 111. Mr. Brown.

113. Electric Railways. Two credit hours. First semester. Electrical Engineering, fourth year. Alternative with Electrical Engineering 115, 117, and 119. Prerequisite, Electrical Engineering 104; concurrent, Electrical Engineering 109. Mr. Caldwell.

Systems, apparatus, and railway operation.

115. Telephony. Two credit hours. First semester. Electrical Engineering, fourth year. Alternative with Electrical Engineering 113, 117, and 119. Prerequisites, Electrical Engineering 104 and 108. Mr. Flowers.

Methods of telephone operation, simple circuits, apparatus and elements of transmission theory.

117. Electric Illumination. Two credit hours. First semester. Electrical Engineering, fourth year. Alternative with Electrical Engineering 113, 115, and 119. Prerequisites, Electrical Engineering 104 and 108. Mr. Caldwell.

Principles of illumination, electric lamps, etc.

119. Wireless Telegraphy. Two credit hours. First semester. Electrical Engineering, fourth year. Alternative with Electrical Engineering 113, 115, and 117. Prerequisites, Electrical Engineering 104 and 108. Mr. Brown.

Elementary theory, production, transmission, and detection of damped and undamped oscillations.

121. Electrical Design. Three credit hours. First semester. Two three-hour drawing periods per week. Electrical Engineering, fourth year. Prerequisite, Electrical Engineering 104. Mr. Flowers. Design of direct current dynamos, transformers, etc.

122. Electrical Design. Two credit hours. Second semester. A continuation of Electrical Engineering 121. One four-hour drawing period per week. Electrical Engineering, fourth year. Elective. Mr. Flowers.

Alternating current apparatus.

124. Electrical Transmission and Distribution. Three credit hours. Second semester. Three lectures per week. Electrical Engineering, fourth year. Prerequisite, Electrical Engineering 109. Mr. Caldwell.

Transmission and distribution systems, apparatus, and operation.

125. Special Reading and Laboratory. First semester. Credit hours to be arranged. Elective for fourth year electrical engineering and graduate students with the consent of the instructor in charge. Prerequisites, Electrical Engineering 104 and 108.

126. Special Reading and Laboratory. Second semester. Credit hours to be arranged. Elective for fourth year electrical engineering and graduate students with the consent of the instructor in charge.

127. Thesis. One credit hour. First Semester. Electrical Engineering, fourth year, Prerequisites, Electrical Engineering 104 and 108.

128. Thesis. Five credit hours. Second semester. Electrical Engineering, fourth year.

130. Inspection Trip. April 13 to 20, 1916. Electrical Engineering, fourth year. Prerequisite, Mechanics 102.

Includes Pittsburg, Buffalo, Niagara, and Cleveland. The entire expense need not exceed $35. A satisfactory written report on the work of the trip and an examination are required.

134. Reading Course. Electrical Engineering, fourth year. This may be taken as a substitute for Electrical Engineering 130 on presentation of reasons satisfactory to the head of the department.

Assigned reading on processes of manufacture and power plants.

131. Inspection Trip. First semester. Electrical Engineering. Third year. February 2 to 5, 1916. Visit to works of electrical and industrial interest at Columbus, Dayton and other nearby points. A written report and examination are required.

138. Advanced Laboratory. Two credit hours. Second semester. One four-hour laboratory period. Electrical Engineering, fourth year. Elective. Mr. Caldwell.

Selected tests on alternating current apparatus, illumination, railways, etc.

For Graduate courses in this department see the Bulletin of the Graduate School.

ENGINEERING DRAWING

Office 204, Brown Hall

PROFESSOR FRENCH, ASSISTANT PROFESSORS MEIKLEJOHN,
WILLIAMS, SHEETS, MR. HARPER, MR. TURNBULL,
MR. GILBERT, MR. SVENSEN

101. Elementary Mechanical Drawing. Two credit hours. Either semester. All four-year courses, first year. Mr. French and department instructors.

Practice in the use of drawing instruments, elementary projections

102. Mechanical Drawing. Three credit hours. Either semester. All four-year courses, first year. Prerequisite, Drawing 101. Lettering, orthographic, isometric, and oblique projections. Mr. French and department instructors.

103. Descriptive Geometry. Three credit hours. First semester. Two recitations, one drawing period per week. Ceramic, Chemical, Electrical, Mechanical, and Mining Engineering, second year. Prerequisite, Drawing 102 or 114. Mr. French and department instructors.

104. Machine Sketching. Three credit hours. Second semester. One lecture, two drawing periods per week. Ceramic, Chemical, Mechanical and Mine Engineering, second year. Prerequisite, Drawing 103. Mr. Williams, Mr. Sheets, Mr. Gilbert, Mr. Svensen.

105. Descriptive Geometry. Three credit hours. First semester. Two lectures, one drawing period per week. Civil Engineering, second year. Prerequisite, Drawing 102. Mr. Turnbull, Mr. Harper.

106. Advanced Descriptive Geometry. Three credit hours. Second semester. Two lectures, one drawing period per week. Civil Engineering second year. Prerequisite, Drawing 105. Mr. Turnbull, Mr. Harper.

107. Descriptive Geometry. Three credit hours. First semester. Two recitations, one drawing period per week. Architecture, second year. Prerequisite, Drawing 102. Mr. Meiklejohn.

110. Technical Sketching. Two credit hours. Second semester. Electrical Engineering, second year. Prerequisite, Drawing 103. Mr. Williams, Mr. Sheets.

111. Technical Drawing. Two credit hours. First semester. Mechanical and Electrical Engineering, third year. Prerequisite, Drawing 104 or 110. Mr. Williams, Mr. Svensen.

113. Free-hand Drawing and Lettering. Four credit hours. First semester. Short courses in Clayworking and Industrial Arts, first year; Short Mining course, second year. Mr. Svensen.

114. Mechanical Drawing. Three credit hours. Second semester. Short courses in Clayworking, Industrial Arts, first year; Short Mining, second year. Prerequisite, Drawing 113. Mr.Svensen.

121. Technical Drawing. Two credit hours. First semester. Chemical Engineering, third year. Prerequisite, Drawing 104. Mr. Withrow, Mr. Svensen.

Designing of chemical plants and machinery.

122. Technical Drawing. Two credit hours. Second semester. Continuation of 121. Chemical Engineering, third year. Mr. Withrow, Mr. Svensen.

ENGLISH

Office 103, Physics Building

PROFESSORS DENNEY, GRAVES, ASSISTANT PROFESSORS COOPER, BECK, MR. CRAIG, MR. DISHONG, MR. CONE, MISS WAKEFIELD AND DEPARTMENT ASSISTANTS.

101. Paragraph Writing: Description and Narration. Two credit hours. Either semester.

English 101 is given also in the Summer Session.

104. Paragraph Writing: Exposition and Argumentation. Two credit hours. Either semester. Prerequisite, English 101.

English 104 is also offered also in the Summer Session.

GEOLOGY

Office 104, Orton Hall

PROFESSORS PROSSER, BOWNOCKER, ASSISTANT PROFESSOR HILLS, MR. VERWIEBE, MISS MARK

162. Elementary Physiography. Four credit hours. Second semester. Short Mining, first year. Miss Mark.

The physiographic features of the earth's surface and the agencies producing them; the atmosphere; the ocean. Recitations, lectures, map work, and field work.

164. Elementary Geology. Three credit hours. Second semester. Short Mining, second year. Mr. Verwiebe.

Lithological, dynamical, structural, and historical geology. Recitations, lectures, and laboratory work.

165. General Geology. Three credit hours. First semester. Mine Engineering, third year; Ceramic Engineering, fourth year. Mr. Prosser, Mr. Verwiebe.

Structural, dynamical, and historical geology. The lectures are illustrated by maps, specimens, and lantern views. The common rockforming minerals and rocks are studied in the laboratory. The first half of the semester, field trips Friday afternoon or Saturday morning will alternate with laboratory periods.

166. Petrography. Two credit hours. Second semester. Mine Engineering, third year. Mr. Bownocker.

A study of hand specimens of igneous, metamorphic, and sedimentary rocks. Lectures and laboratory work.

167. Economic Geology. Three credit hours. First semester. Mine Engineering, fourth year. Prerequisite, Geology 165-166. Mr. Bownocker.

The nature and origin of ores; their modes of occurrence and distribution. The non-metals, coal, oil, gas, clay, lime, cement, and building stones. In the discussion of the non-metals emphasis will be laid on the products of Ohio.

168. General Geology. Three credit hours. Second semester. Civil Engineering, second year. Mr. Prosser, Mr. Verwiebe.

Structural, dynamical, and historical geology. The lectures are illustrated by maps,specimens, and lantern views. The common rock forming minerals and rocks are studied in the laboratory. The last half of the semester, field trips Friday afternoon or Saturday morning will alternate with laboratory periods.

For Graduate courses in this department see the Bulletin of the Graduate school.

GERMAN

Offices 317 and 318, University Hall

PROFESSORS EVANS, EISENLOHR, ASSISTANT PROFESSORS THOMAS, BARROWS, LEWISOHN, BUSEY, DR. KEIDEL, MR. KOTZ, MR. NORDMEYER AND DEPARTMENT ASSISTANTS

101-102. Elementary German. Four credit hours. The year. Open to students in any four-year course who enter with a foreign language other than German.

The essentials of grammar and oral practice, first semester.

Reading of easy narrative, grammatical drill, second semester.

German 101 is given also the second semester.

103. Intermediate German. Four credit hours. Prerequisite, German 102 or two units entrance credit in German. Not open to students who enter with four units entrance credit in German.

Reading of narrative prose, with topical review of grammar. One hour prose composition each week.

German 101 is given also the second semester.

106. Science Reading. Four credit hours. Second semester. This course is for engineering students; a continuation of German 103 and 107.

Rapid reading of German technical literature. Drill on sentence structure and word formation. The object of the course is to prepare students to read technical works and current technical literature.

107. Advanced German. Four credit hours. Open to first year students who enter with four units credit in German. By agreement with the College of Engineering, students may on securing permission continue this course in the second semester in place of 106.

INDUSTRIAL ARTS AND SHOPWORK

Office 103, Hayes Hall

PROFESSOR SANBORN, ASSOCIATE PROFESSOR KNIGHT, MR. CASE, MR. BEEM, MR. FOUST, MR. DENMAN, MR. SMITH, MR. BRECKUR, MR. WRIGHT

INDUSTRIAL ARTS

101. Tools and Machines. Three credit hours. Second semester. Three recitations per week. Short Industrial Arts, second year. Prerequisite, Mathematics 114 or 132. Concurrent, Physics 101. Mr. Sanborn.

Principles underlying the construction and operation of machines with a special study of machine tools.

103. Designing. One credit hour. Second semester. Three laboratory hours per week. Short Industrial Arts, second year, Concurrent, Industrial Arts 101. Mr. Sanborn.

112. Machine Design. Two credit hours. Second semester. Four laboratory hours per week. Electrical Engineering, fourth year. Prerequisite, Mechanics 102 and Engineering Drawing 111. Mr. Sanborn.

Practical application of principles of machine design.

114. Shop Building. Two credit hours. Second semester. Two recitations per week. Alternative with Mechanical Engineering 146, fourth year. Prerequisite, Civil Engineering 126. Mr. Sanborn.

Lectures and problems on the construction of shop buildings and the arrangement of machinery; special shop appliances.

SHOPWORK

(The classes in shopwork are carried under a different set of numbers from the preceding theoretical classes in Industrial Arts, though they are in the same department.)

105. Foundry Work. Two credit hours. Either semester. One recitation and four laboratory hours per week. Mechanical Engineering, second year. Second semester, Short Industrial Arts, first year. Mr. Beem, Mr. Breckur.

Exercises and practice on tempering sand and preparing molds of machine parts in sand, core-making, melting iron and brass, and pouring.

107. Chipping and Filing. Two credit hours. Either semester. One recitation and four laboratory hours per week. Mechanical Engineering, second year. Ceramic Engineering and Short Clay-working, alternative with 109 and 115. Second semester, Short Industrial Arts, first year. Mr. Case.

Exercises and practice in vise work including chipping in cast and wrought iron, surface filing, squaring, fitting, finishing, and the scraping of surface plates.

109. Joinery and Pattern-Making. Two credit hours. Either semester. One recitation and four laboratory hours per week. Short Industrial Arts, first year. Ceramic Engineering and Short Clayworking, alternative with Shopwork 107 and 115. Chemical Engineering, Electrical Engineering, Mechanical Engineering, and Mine Engineering, during the Summer Session at the close of the first year. Mr. Beem, Mr. Denman, Mr. Smith.

Exercises and practice in joinery, wood-turning, and pattern-making, including sawing, planing, mortising, framing, and other work involving the use of the ordinary carpenter tools, center and chuck turning, and making of finished patterns.

111. Advanced Pattern-Making. One credit hour. Either semester. Three laboratory hours per week. Mechanical Engineering, second year. Second semester, Short Industrial Arts, first year. Prerequisite, Shopwork 109. Mr. Beem, Mr. Denman, Mr. Smith.

113. Cabinet-Making. Two credit hours. Either semester. Six laboratory hours per week. Elective. Prerequisite, Shopwork 109. Mr. Beem, Mr. Denman, Mr. Smith.

Exercises and practice in cabinet-making, including paneling, mitre and dove-tail joints; use of power tools.

115. Forging. Two credit hours. Either semester. One recitation and four laboratory hours per week. Short Industrial Arts, second year. Short Mining, first year. Ceramic, Chemical, Electrical, Mechanical, and Mine Engineering and Short Clay-working, during the Summer Session at the close of the first year. Mr. Foust, Mr. Wright.

The use and care of forge, fire, and tools. Practice in iron and steel forging, including such operations as cutting, bending, drawing, upsetting, shaping, and welding iron; the making, hardening, and tempering of steel punches, chisels, and lathe tools.

118. Advanced Forging. Two credit hours. Six laboratory hours per week. Elective, second semester. Prerequisite, Shopwork 115. Mr. Foust, Mr. Wright.

Various forms of welds in iron and steel; the use of scrolling irons and of forms for duplicating work; annealing; tool-making, (case-hardening; tempering drills, dies, and cutters; spring-making); ornamental iron work; visits to shops.

119. Machine Work. Three credit hours. Either semester. One recitation and six laboratory hours per week. Electrical and Mechanical Engineering and Short Industrial Arts, second year. Mr. Knight, Mr. Case.

Elementary exercises on the engine lathe, such as plain, straight and taper turning, screw cutting, chucking, boring, filing, and polishing, and the use of the drill press.

121. Advanced Machine Work. Three credit hours. Either semester. One recitation and six laboratory hours per week. Mechanical Engineering, third year; Electrical Engineering and Short Industrial Arts, second year. Prerequisite, shopwork 119. Mr. Knight, Mr. Case.

A continuation of Shopwork 119 with more difficult exercises on the lathe, including square thread cutting, drilling, and tapping, use of steady rest, face-plate work, and bar turning. Also practice on the milling machines, planer, shaper and turret lathe.

123. Advanced Machine Work. Two credit hours. First semester. Six laboratory hours per week. Elective. Prerequisite, Shopwork 121. Mr. Knight, Mr. Case.

A more advanced course in milling machine work and grinding, Exercises in spur and spiral gear cutting, cam cutting, and differential and fractional indexing.

125. Construction Work. Two credit hours. Either semester. Six laboratory hours per week. Elective. Prerequisite, Shopwork 121. Mr. Knight, Mr. Case.

A course in construction work on any piece of apparatus or machinery which may be in course of construction in the shops.

127. Tool-Making and Jig Work. Three credit hours. Either semester. Elective. Prerequisite, Shopwork 123. Mr. Knight, Mr. Case.

130. Advanced Pattern Making. Three credit hours. Second semester. Short Industrial Arts.

For Graduate courses in this department see the Bulletin of the Graduate School.

MATHEMATICS

Office 314, University Hall

PROFESSORS BOHANNAN, MCCOARD, SWARTZEL, KUHN, RASOR
ASSOCIATE PROFESSOR ARNOLD, ASSISTANT PROFESSORS
PRESTON, BAREIS, MORRIS, WEST, MISS RICKARD

101. Elementary Algebra. Five credit hours. First semester. Short Clay-working, Short Industrial Arts, and Short Mining, first year.

102. Continuation of Mathematics 101. Five credit hours. Second semester. Short Clay-working, Short Industrial Arts, and Short Mining, first year. Prerequisite, Mathematics 101.

113. Plane and Solid Geometry. Five credit hours. First semester. Short Clay-working, Short Industrial Arts, and Short Mining, first year.

114. Solid Geometry and Plane Trigonometry. Five credit hours. Second semester. Short Clay-working, Short Industrial Arts, and Short Mining, first year. Prerequisite, Mathematics 113.

131. Trigonometry and College Algebra. Five credit hours. Either semester. All four-year courses in Engineering, first year. Prerequisites, Entrance Algebra and Geometry.

132. Analytical Geometry and College Algebra. Either semester. Five credit hours. All four-year courses in Engineering, first year. Prerequisite, Mathematics 131.

This course is given also in the Summer Session.

141. Calculus. Five credit hours. Either semester. All four-year courses in Engineering, second year. Prerequisite, Mathematics 132.

142. Continuation of Mathemetics 141. Five credit hours. Either semester. All four-year courses in Engineering, second year. Prerequisite, Mathematics 141.

This course is given also in the Summer Session.

151. Differential Equations. One credit hour, first semester. MechanicalEngineering, third year. Prerequisite, Mathematics 142.

For Advanced Undergraduates and Graduates

Prerequisite: Differential and Integral Calculus.

***163-164. Plane and Solid Analytical Geometry.** Three credit hours. The year. Mr. Morris.

167-168. Differential Equations. Three credit hours. The year. Mr. Bohannan.

173-174. Modern Higher Algebra. Three credit hours. The year. Mr. Kuhn.

For Graduate courses in this department see the Bulletin of the Graduate School.

---

*Not given in 1915-1916.

MECHANICAL ENGINEERING

Office 244, Robinson Laboratory

PROFESSORS MAGRUDER, MARQUIS, SANBORN, ASSOCIATE PROFESSOR JUDD, MR. BROWN, MR. HERSHISER

101. Mechanism. Three credit hours. First semester. Three recitations per week. Electrical Engineering, third year. Prerequisites, Engineering Drawing 103, Physics 114. Mr. Sanborn.

Recitations on the principles of mechanism and mechanical movements.

103. Steam Power Plants. Three credit hours. First semester. Three recitations per week. Chemical, Electrical, and Mechanical Engineering, third year. Prerequisites, Engineering Drawing 104, Physics 112. Mr. Marquis, Mr. Brown.

A descriptive study of steam-generating and steam-using machinery.

110. Mechanism and Machine Design. Three credit hours. Second semester. Three recitations per week. Ceramic Engineering, third year. Prerequisites, Engineering Drawing 104, Mechanics 101. Mr. Judd.

Recitations on the principles of mechanism, mechanical movements, and elementary machine design.

114. Mechanism. Three credit hours. Second semester. Three recitations per week. Mechanical Engineering, third year. Prerequisites, Engineering Drawing 104, Physics 112. Mr. Sanborn.

Recitations and practice on the principles of mechanism and mechanical movements.

116. Mechanism Drawing. One credit hour. Second semester. One three-hour drawing period per week. Mechanical Engineering, third year. Prerequisite or concurrent, Mechanical Engineering 114. Mr. Sanborn.

Practice in laying out mechanisms and mechanical movements.

118. Steam Engines. Three credit hours. Second semester. Three recitations per week. Electrical and Mechanical Engineering, third year. Prerequisites, Mechanical Engineering 103, Mechanics 101. Mr. Magruder, Mr. Marquis.

120. Steam Boilers. One credit hour. Second semester. One recitation per week. Mechanical Engineering, third year. Prerequisites, Mechanical Engineering 103, Mechanics 101. Mr. Marquis.

121. Heating and Ventilating. Two credit hours. First semester. Two recitations per week. Architecture, fourth year. Prerequisite, Mechanics 101. Mr. Marquis.

Recitations and lectures on the principles and methods of heating and ventilation, with laboratory work and investigations of the heating and ventilating plants of different buildings.

123. Materials of Construction. Two credit hours. First semester. One recitation and three laboratory hours per week. Architecture, fourth year. Prerequisite, Mechanics 101. Mr. Judd.

Lectures and recitations on the materials used in architectural and building construction, and laboratory exercises on their properties.

125. Gas Engines and Producers. Two credit hours. First semester. Two recitations per week. Mechanical Engineering, fourth year. Prerequisite, Mechanical Engineering 118. Mr. Magruder.

A study of gas-engines and of gas-producers as used for power purposes.

127. Machine Design. Five credit hours. First semester. Five recitations per week. Chemical and Mechanical Engineering, fourth year. Prerequisites, Engineering Drawing 104 and 111, Mechanics 102, Metallurgy 109, Mechanical Engineering 103. Mr. Magruder, Mr. Sanborn.

A detailed course of study based upon mechanics and the materials of construction applied to the design and construction of machinery.

129. Thermodynamics. Two credit hours. First semester. Two recitations per week. Mechanical Engineering, fourth year. Prerequisite, Mechanical Engineering 118. Mr. Magruder.

The transmutations of heat and mechanical energies in steam and air engines, in air and ammonia compressors, and in refrigeration machines, together with a study of the tests of ideal and actual engines and of their indicator diagrams; the flow of gases through pipes and orifices.

130. Inspection Trip. April 13 to 20, 1916. Required in Mechanical Engineering, fourth year. Prerequisite Mechanics 102.

Includes Pittsburgh, Buffalo, Niagara Falls, Cleveland, and possibly other places. The entire expense need not exceed $35. A satisfactory written report upon the work of the trip and examination are required.

134. Reading Course. Mechanical Engineering, fourth year. Written report on assigned reading upon processes of manufacture and power plants. This may be taken as a substitute for Mechanical Engineering 130 on presentation of reasons satisfactory to the head of the department.

140. Mechanism and Machine Design. Two credit hours. Second semester. Two recitations per week. Civil Engineering, fourth year. Prerequisite, Mechanics 102. Mr. Judd.

An elementary course in the principles of mechanism and mechanical movements and the design of parts of machines.

142. Hydraulic Machinery. Two credit hours. Second semester. Two recitations per week. Mechanical Engineering, fourth year. Prerequisites, Mechanics 102, Mechanical Engineering 118. Mr. Judd.

A study of pumping machinery.

144. Machine Design. Five credit hours. Second semester. Three recitations and two three-hour drawing periods per week. Chemical and Mechanical Engineering, fourth year. Prerequisite, Mechanical Engineering 127. Mr. Magruder and Mr. Sanborn.

A continuation of Mechanical Engineering 127, with practical applications on the drawing board of the principles to the design of some particular machine.

146. Steam Turbines. Two credit hours. Second semester. Two recitations per week. Optional in Mechanical Engineering with Industrial Arts 114, fourth year. Prerequisite, Mechanical Engineering 129. Mr. Marquis.

A study of the generation of power by steam turbines, including auxiliary machinery.

148. Thesis Work. Three credit hours. Second semester. Mechanical Engineering, fourth year. Prerequisites, Mechanical Engineering, 125, 127, 129, and 179. Mr. Magruder, Mr. Marquis, Mr. Judd.

A special investigation or design based upon the work of the courses.

150. Hydraulic power. Three credit hours. Second semester. Two recitations and three laboratory hours per week. Elective in Civil, Electrical, and Mechanical Engineering, fourth year. Prerequisites, Mechanical Engineering, 173, 175, or 179. Mr. Judd.

A study of hydraulic turbines and the generation of hydraulic power.

160. Experimental Engineering Laboratory. Two credit hours. Second semester. Four laboratory hours per week. Electrical Engineering, third year. Concurrent, Mechanics 102. Mechanical Engineering 118. Mr. Marquis, Mr. Judd, Mr. Brown.

Calibration of pressure gages and indicator springs; steam engine indicator practice; testing of lubricating oils; and the materials of construction.

164. Experimental Engineering Laboratory. Two credit hours. Second semester. Four laboratory hours per week. Mechanical Engineering, third year. Concurrent, Mechanics 102, Mechanical Engineering 118. Mr. Marquis, Mr. Judd, Mr. Brown.

Calibration of pressure gages and indicator springs; steam engine indicator practice; testing of oils; and the materials of construction.

171. Experimental Engineering Laboratory. Three credit hours. First semester. One recitation and four laboratory hours per week. Elective in Ceramic and Chemical Engineering, fourth year. Prerequisites, Mechanics 101 and 102 or 104. Mr. Judd, Mr. Brown.

Selected laboratory exercises in the testing of lubricants and the materials of construction; calibration of pressure gages and indicator springs; steam engine indicator practice; and brake tests of steam engines.

173. Experimental Engineering Laboratory. Five credit hours. First semester. Two recitations and six laboratory hours per week. Civil Engineering, fourth year. Prerequisite, Mechanics 102. Mr. Marquis, Mr. Judd, Mr. Brown.

Practice in the testing of the materials of construction; calibration of orifices and weirs; study of the flow of liquids and gases; tests of steam, power, rotary, and centrifugal pumps; tests of water motors and turbine water wheels. Lectures and recitations on same and on steam engines, boilers, and transmission machinery.

175. Experimental Engineering Laboratory. Three credit hours. First semester. Six laboratory hours per week. Electrical Engineering, fourth year. Prerequisites, Mechanical Engineering, 118 and 160. Mr. Marquis, Mr. Judd, Mr. Brown.

Tests of steam engines and boilers; gas and oil engines; steam and power pumps; hydraulic experimentation; and the use of transmission and absorption dynamometers.

179. Experimental Engineering Laboratory. Two credit hours. First semester. Four laboratory hours per week. Mechanical Engineering, fourth year. Prerequisite, Mechanical Engineering 164. Concurrent, Mechanical Engineering 125 and 129. Mr. Marquis, Mr. Judd, Mr. Brown.

Valve setting, moisture determinations in steam, gas calorimetry, measurements of flow of water by means of orifices, nozzles, weirs, and venturi-meter; tests of belts with use of transmission and absorption dynamometers.

190. Experimental Engineering Laboratory. Six credit hours. Second semester. Twelve laboratory hours per week. Mechanical Engineering, fourth year. Prerequisites, Mechanical Engineering 125, 129, and 179. Mr. Marquis, Mr. Judd, Mr. Brown.

Tests of steam and hot-air engines; steam boilers; gas and oil engines; gas producers; air compressors; injectors and pulsometers; centrifugal, rotary, and power pumps; hydraulic rams, impulse and turbine water wheels; fans and blowers, and steam turbines.

192. Experimental Engineering Laboratory. Three credit hours. Second semester. One recitation and four laboratory hours per week. Mine Engineering, fourth year. Prerequisites, Mechanics 102, Metallurgy 109. Mr. Judd, Mr. Brown.

Lectures and recitations on power transmission, steam and gas engines, steam boilers, and gas producers. Laboratory work in the calibration of pressure gages and indicator springs; valve setting; testing of steam engines, testing of steam and centrifugal pumps; boiler and fuel trials; tests of gas engines and gas producers.

For Graduate courses in this department see the Bulletin of the Graduate School.

MECHANICS

Office 219, Lord Hall

PROFESSORS BOYD AND CODDINGTON

The laboratory work in strength of materials, involving the use of testing machines, is given at present in the Department of Mechanical Engineering.

101. Statics and Strength of Materials. Five credit hours. First semester. Architecture, Ceramic, Chemical, Civil, Electrical, Mechanical, and Mine Engineering, third year. Prerequisite, Mathematics 142.

102. Strength of Materials, continued: Kinetics and Hydraulics. Five credit hours. Second semester. Chemical, Civil, Electrical, Mechanical, and Mine Engineering, third year. Prerequisite, Mechanics 101.

104. Strength of Materials. Two credit hours. Second semester. Architecture and Ceramic Engineering, third year. Prerequisite, Mechanics 101.

For Graduate courses in this department see the Bulletin of the Graduate School.

METALLURGY

Office 100, Lord Hall

PROFESSORS SOMERMEIER AND DEMOREST

102. Mineral Chemistry. Four credit hours. Second semester. Short Mining, second year. Prerequisite, Chemistry 101. Mr. Demorest, Mr. Minor.

A course of lectures upon mine gases, safety lamps, mine explosions, boiler water, mine water, water supply, explosives, coal, and coke.

105. Fire Assaying. Three credit hours. First semester. Mine Engineering, third year. Laboratory, two afternoons per week, Monday and Tuesday, or Thursday and Friday. Prerequisite, Metallurgy 106, or equivalent.

Lectures and laboratory work. Practical work in the assaying of gold, silver, and lead ores.

106. Metallurgical Analysis. Four credit hours. Second semester. One lecture, nine laboratory hours per week. Mine Engineering, second year. Prerequisite, Chemistry 106 or 110, Chemistry 119. Mr. Demorest.

Lectures and laboratory work. Laboratory work in the analysis of iron ores, iron and steel, fuel and slags, and ores of lead, zinc, and copper by wet methods, using approved methods as practiced in technical laboratories and metallurgical works.

107. Alloy Analysis. Four credit hours. First semester. One lecture, nine laboratory hours per week. Mine Engineering, third year. Prerequisite, Metallurgy 106. Mr. Demorest.

Lectures and laboratory work. Laboratory work in the analysis of alloy steels, such as vanadium, tungsten, chromium, nickle and molybdenum steels, and other alloys. Quantitative work preceded by qualitative tests on the alloys.

117. Fuel. Two credit hours. First semester. Four recitations per week during first half of first semester. Chemical, Mechanical and Mine Engineering third year; Ceramic Engineering, fourth year. Prerequisite: Chemistry 106 or 110 and Physics 112 or 114, Mr. Somermeier.

Lectures, recitations and problems on fuels, their properties, uses, and manufacture.

119. Iron and Steel. Two credit hours. First semester. A continuation of Metallurgy 117. Four recitations per week during second half of first semester. Chemical, Mechanical and Mine Engineering, third year; Ceramic Engineering, fourth year. Mr. Demorest.

Lectures, recitations and problems on Metallurgy of iron and steel.

110. Metallurgy of Non-Ferrous Metals. Four credit hours. Second semester. Mine Engineering, third year. Mr. Demorest.

Lectures and recitations on the metallurgy and properties of the non-ferrous metals; copper, lead, gold, silver.

111. Principles of Metallurgical Construction. One credit hour. Two recitations during first half of first semester. Mine Engineering, fourth year. Prerequisites: Drawing 111, Mechanics 102, Metallurgy 109 and 113. Mr. Somermeier.

Lectures and recitations on the principles involved in the designing of furnaces and metallurgical plants.

112. Technical Gas Analysis. Two credit hours. Second semester. Mine Engineering, third year. Two afternoons per week. Prerequisites, Metallurgy 106, 109, or equivalent. Mr. Demorest.

Laboratory work supplemented by lectures. Technical analysis of metallurgical and mine gases. Determination of the calorific value of gases; problems involving application of results of gas analysis to furnace operation, mine ventilation, etc.

113. Ore Dressing and Coal Washing. Two credit hours. First semester. Mine Engineering, fourth year. Prerequisite, Metallurgy 109.

Methods of concentrating and enriching ores and fuels by mechanical means. Lectures with references to standard books and various papers in technical journals.

114. Special Metallurgy. Three credit hours. Second semester. Mine Engineering, fourth year. Hours to be arranged. Prerequisites, Metallurgy 106, 107, 109, 110, or equivalent. Mr Demorest.

Laboratory practice supplemented by lectures on microscopic examination of metals, study of properties of alloys, testing of metallurgical processes, pyrometry, and high temperature measurements, calorimetry, and other tests on fuels.

116. Thesis. Three credit hours. Second semester.

For Graduate courses in this department see the Bulletin of the Graduate School.

MILITARY SCIENCE AND TACTICS

Office, The Armory

CAPTAIN GEORGE L. CONVERSE, U. S. A., RETIRED AND
LIEUTENANT THORPE, U. S. A., RETIRED

In accordance with the Morrill Act, passed in 1865, under which the University was established, military instruction must be included in the curriculum. The Board of Trustees therefore requires all male students, special as well as regular, *unless excused by the Military and Gymnasium Board*, to drill during two years. The work is under two officers of the regular army, detailed for the purpose, The Military Department is open during five days each week throughout the year.

1. **Military Drill.** One credit hour. Five months, three hours per week (divided between fall and spring) military drill; four months three hours per week, (winter) of class-room instruction in drill regulations. Target practice at any open hour during the afternoons of the winter months, at 100, 200, and 300 yards. Lecture, one hour each week, by the President, upon topics of common interest to the student body.

2. **Military Drill.** One credit hour. Five months, three hours per week, (divided between fall and spring) in extended order and guard duty. Four months, three hours per week (winter) of class-room instruction in Articles of War, guard manual and field service, regulations. Target practice, at any open hour of the afternoons of the winter months, at 500, 600, and 800 yards.

MINE ENGINEERING

Office 200, Lord Hall

PROFESSOR RAY, ASSISTANT PROFESSOR MINOR

101. Mine Engineering. Five credit hours. First semester. Lectures and field practice. Short Course in Mining, second year. Prerequisite, Mathematics 114. Mr. Minor.

This course is similar to Mine Engineering 103, but more elementary. The same text is used. The students have more practice in the drawing room.

102. Mine Engineering. Five credit hours. Second semester. Short Course in Mining, second year. Prerequisites, Mine Engineering 101, Physics 101. Mr. Minor.

Lectures illustrated by experiments, and maps of mines and models when possible; tests by safety lamps and anemometers; methods of air distribution in coal mines.

103. Mine Surveying. Four credit hours. First semester; Mine Engineering, second year; Ceramic Engineering, third year. Prerequisites, Engineering Drawing 104, Mathematics 132. Mr. Ray, Mr. Minor.

Field practice in the use of instruments for surface and underground surveys. Field notes are taken and maps and plans made in the drawing room.

104. Plans and Specifications. Four credit hours. Second semester. Mine Engineering, fourth year. Prerequisites, Mine Engineering 105, Metallurgy 111. Mr. Ray, Mr. Minor.

Practice in designing mine plants, drafting, and estimating.

105. Mine Engineering. Five credit hours. first semester. Mine Engineering, fourth year. Prerequisites, Mechanics 102, Mine Engineering 103, Geology 165. Mr. Ray.

Lectures on mine operating, mining machinery, ventilation, shaft sinking, working out deposits, etc. Constant reference is required to standard works and to the leading technical journals.

106. Mine Engineering. Five credit hours. Second semester. Mine Engineering, fourth year, Prerequisite, Mine Engineering 105. Mr. Ray.

A continuation of Mine Engineering 105.

107. Mine Engineering. Two credit hours. First semester Four laboratory hours per week. Short Mining, second year. Mine Engineering 101, concurrent. Mr. Minor.

109. Mine Trip. One credit hour. First semester. Mr. Minor.

110. Mine Trip. One credit hour. Second semester. Mr. Minor.

111. Metallurgical Design. One credit hour. First semester. Mine Engineering, fourth year. Six laboratory hours per week during the second half of the first semester. Prerequisites: Drawing 111. Mechanics 102, Metallurgy 111, 113, 117, and 119. Mr. Minor.

Drawing room practice on the designing of furnaces and metallurgical plants.

116. Thesis. Three credit hours. Second semester. Mr. Ray, Mr. Minor.

For Graduate courses in this department see the Bulletin of the Graduate School.

MINERALOGY

Office 104, Lord Hall

ASSISTANT PROFESSOR McCAUGHEY

102. Crystallography and Mineralogy. Three credit hours. Second semester. Mine Engineering, second year; Chemical Engineering, third year; Pharmacy, fourth year. Prerequisite, Chemistry 106 or 110.

Lectures on Crystallography, Physical and Descriptive Mineralogy. Illustrated by drawings, models, and mineral specimens.

104. Determinative Mineralogy. Three credit hours. Second semester. One lecture, six laboratory hours per week. Mine Engineering, third year. Prerequisite, Mineralogy 102.

Lectures and laboratory work in practical determination of minerals by physical and chemical tests. Each student is furnished with a set of apparatus and works under an instructor's inspection. Brush and Penfield's "Determinative Mineralogy" is used as a manual.

121. Microscopic Mineralogy. Three credit hours. First semester. One lecture and six laboratory hours per week. Prerequisites, Mineralogy 102 and Physics 114.

The use of the polarizing microscope in the identification of minerals in fine powder and in thin section. Determination of the optical constants of minerals and crystallized bodies with the polarizing microscope.

124. Microscopic Petrography. Three credit hours. Second semester. Prerequisites, Geology 165, 166, Mineralogy 102, 121.

The study of igneous and metamorphic rocks, especially their mineralogical and chemical composition, also their textural and genetic relations. Laboratory work with petrographic microscope and thin section of rocks.

126. Advanced Crystallography and Physical Mineralogy. Three credit hours. Second Semester. Two lectures and one laboratory period. Prerequisites, Physics 114, Mineralogy 102.

The study of the geometrical and physical properties of crystals. Laboratory work on the measurement, calculation, and projection of crystals and the determination of the physical and optical constants of crystallized bodies.

PHYSICAL EDUCATION

Office, The Gymnasium

DR. WINGERT, MR. OHLSON
MR. BARTHOLOMEW

Physical Education. One credit hour. The year. Two hours per week. Required of all first-year students. In the case of women, two years are required. During the first semester the course consists of one lecture on personal hygiene and one period of active physical exercise each week.

(a). Personal Hygiene. Lectures and quizzes on the cause, prevention, and hygiene treatment of the common preventable diseases and conditions which lower the vitality and interfere with the health and efficiency of the students.

(b). Physical exercise in class. A graded course of free-hand exercises, with light hand apparatus for the relief and correction of slight bodily defects, improper carriage; etc. Progressive exercises on the apparatus and mats, to promote muscular tone, organic vigor, bodily skill; etc. Dancing, gymnastic and athletic games and contests.

MEDICAL EMERGENCY SECTION

In the Gymnasium

This department maintains a medical emergency section, open to all students, male or female, in the department. Emergency medical advice and treatment is furnished free to students while on the campus, during regular University hours.

PHYSICS

Office 107, Physics Building

PROFESSORS COLE, EARHART, BLAKE, BARNETT, SHEARD
ASSISTANT PROFESSOR SMITH, MR. HEIL, MR. WOODBURY,
MR. STRAIT AND DEPARTMENT ASSISTANTS

101. Elementary Physics. Six credit hours. First semester. Five recitations and lectures, and three laboratory hours per week. Short Clay-working, second year; Short Mining, first year. Textbook, Millikan and Gale's Elements of Physics. Mr. Heil.

111. General Physics. Three credit hours. First semester. Two lectures, one recitation, and two laboratory hours per week. Architecture, Chemical, Civil, Ceramic, and Mine Engineering, second year. Prerequisites, Elementary Physics and Mathematics 132. All instructors. Lectures by Mr. Cole.

112. Continuation of Physics 111. Three credit hours. Second semester. Two lectures, one quiz, and two laboratory hours per week. Ceramic, Chemical, Civil, Mine and Mechanical Engineering, second year. Prerequisite, Physics 111. All instructors. Lectures by Mr. Cole.

113. General Physics. Five credit hours. First semester. Two lectures, three recitations, and two laboratory hours per week. Electrical and Mechanical Engineering, second year. Prerequisites, Elementary Physics and Mathematics 132. All instructors. Lectures by Mr. Cole.

Mechanics and heat.

114. General Physics. Five credit hours. Second semester. Two lectures, three recitations, and two laboratory hours per week. Electrical Engineering, second year. Prerequisite, Physics 113. All instructors. Lectures by Mr. Cole.

Electricity, Light, and Sound. A continuation of Physics 113.

133. Physical Laboratory. Two credit hours. First semester. Four laboratory hours per week. Electrical Engineering, second year. Concurrent, Physics 113. Mr. Smith, Mr. Heil.

134. Electrical Measurements and Photometry. Three credit hours. Second semester. Six laboratory hours per week. Electrical Engineering, second year. Concurrent, Physics 114, Mathematics 142. Mr. Barnett, Mr. Strait.

135. Electrical Measurements and Photometry. Five credit hours. First semester. Nine laboratory hours per week. A continuation of Physics 134. Electrical Engineering, third year. Prerequisites, Physics 114 and 134, Mathematics 141-142. Mr. Barnett. Mr. Strait.

136. Physical Laboratory. Four credit hours. Second semester. Six laboratory hours per week, in electrical measurements; two laboratory hours per week, in mechanics and heat experiments. General Engineering, second year. Concurrent Physics 114 and Mathematics 142. Mr. Barnett, Mr. Strait.

137. Physical Laboratory. Three to five credit hours. First semester. Prerequisite or concurrent, Physics 111. Elective.

138. Physical Laboratory Two credit hours. Second semester. Four laboratory hours per week. Mechanical Engineering, second year. Prerequisite, Physics 111; concurrent, Physics 112. Elective, three to five credit hours. Mr. Smith. Mr. Heil.

139-140. Advanced Electrical Measurements. Three to five credit hours. The course may be elected either semester. Prerequisite, Physics 135 or equivalent. Mr. Barnett.

This course is subject to considerable variation to meet the needs of individual students, but a large amount of time is always devoted to oscillograph work.

123-124. Advanced Laboratory. Three to five credit hours. The year. Prerequisite, Physics 121-122. Mr. Cole.

144. Electricity. Three credit hours. Second semester. Prerequisite, Physics 103-104 or 105-106; calculus precedes or accompanies Mr. Earhart.

For Graduate courses in this department see the Bulletin of the Graduate School.

ROMANCE LANGUAGES AND LITERATURE

Office 305, University Hall

PROFESSORS BOWEN, BRUCE, INGRAHAM, ASSISTANT PROFESSORS HAMILTON, CHAPIN, PIERCE, MR. DITCHY, MR. MOORE

FRENCH

101-102. Elementary French. Four credit hours. The year. Four recitations per week. May be taken by students in any four-year course who enter with no entrance credits in French. Text-books: Fraser and Squair's Grammar, or equivalent, and Aldrich and Foster's or Bowen's First Scientific Reader. Followed by historical and narrative prose; one or more prose comedies.

103. Modern French Literature. Four credit hours. First semester. Four recitations per week. May be taken by first year students in any four-year course who enter with two units entrance credit in French. Prerequisite, French 101-102, or two units entrance credits.

Nineteenth Century Prose, including (1) contes, (2) the novel (Balzac or Hugo). Prose composition, with practice in speaking. Systematic attention given to syntax and idiom.

106. Science Reading. Four credit hours. Second Semester. Four recitations per week. Must be taken by students in Engineering who take French 103 during the first semester.

A course of rapid reading introductory to the vocabulary of scientific literature.

SPANISH

101-102. Elementary Spanish. Four credit hours. The year. Four recitations per week. May be taken by students in any four-year course who enter with no entrance credit in Spanish. Textbooks: Ingraham-Edgren's Grammar, or equivalent, and Ingraham's Victoria Otros Cuentos.

Easy prose and plays. Composition and practice in speaking.

103-104. Modern Spanish Literature. Four credit hours. The year. Four recitations per week. May be taken by students who enter with two units entrance credit in Spanish. Prerequisite, Spanish 101-102, or two units entrance credit.

The novel and drama of the nineteenth century. Lectures covering a survey of the literature. Composition and practice in speaking continued.

SHOPWORK

(See Industrial Arts)

SPANISH

(See Romance Languages)

FEES AND EXPENSES

All fees must be paid at the opening of each semester as a condition of admission to classes. Registration is not complete until the incidental and laboratory fees are paid.

Incidental Fee—The fee is fifteen dollars a semester.

Former students, who do not pay this fee until the third day of the first semester and the second day of the second semester, must pay one dollar additional. For each day of delay thereafter, fifty cents is added.

Laboratory Deposit.—Students are required to pay for all materials consumed in laboratory work. To meet the cost of these materials, a deposit for each course requiring such supplies, is made at the Bursar's office before the work is begun. In Chemistry the deposit is ten dollars. In other courses it varies with the amount of materials used. All laboratory supplies are sold at the General Store Room, Chemistry Hall, to students at about first cost to the University, and charged against the deposits. Any unused part of the deposits is refunded at the end of the semester.

Students should present their class-cards to the Bursar when they pay laboratory deposits.

OTHER EXPENSES

Locker Fee—The gymnasium is free to all students, but those desiring to use a locker are charged a fee of two dollors a semester, which includes the rental of towels.

Cadet Uniform—The uniform with which the members of the regiment are required to provide themselves costs (without overcoat) about twelve dollars. It is quiet in pattern and may be worn in place of civilian dress.

New students are advised against buying second-hand uniforms unless they have been previously inspected and approved by the Commandant. Inspection has shown in many cases that second hand uniforms were unfit to wear and certainly not worth the price asked for them. All such uniforms are subject to rejection by the Commandant. Students should not arrange for uniforms until so directed by the military authorities.

Changes in Subjects or Schedule—Changes in subjects or schedule, if made at the request of the student, shall be made only upon the payment of a fee of $1.00 for each change. The fee, in exceptional cases, may be remitted by the executive Committee of the College.

Graduation Fee—A fee of five dollars, to cover expense of graduation and diploma, is required of each person receiving one of the ordinary degrees from the University, and this fee must be paid before the last Friday preceding Commencement. A like fee of ten dollars is charged each person receiving one of the higher graduate degrees.

The Ohio Union—A fee of one dollar a semester is paid by all male students at registration. This entitles the student to all privileges of the Union, consistent with the constitution and house rules governing it.

Text Books—Students should not purchase text-books until they are advised by the instructors of their respective classes.

EXPENSES PER YEAR

One of the most perplexing questions that confronts a prospective student is what the course is going to cost him a year.

In order to furnish information, we have listed below an estimate of the average payments required by the University for the freshman year in the College of Engineering, and have estimated the cost for room and boarding at a safe price. These two items are sometimes reduced slightly where two students occupy the same room and where boarding clubs are economically managed. Fees to the University are paid one-half at the beginning of each semester.

Incidental fee	$ 30 00
Ohio Union	2 00
Gymnasium locker	4 00
Deposits to cover laboratory materials and breakage.	20 00
Drawing instruments and supplies	20 00
Uniform	12 00
Books	15 00
Board—36 weeks at $3.50 per week	126 00
Room rent, at $8.00 per month	72 00
General expenses	100 00
	$401 00

The item of general expenses is always subject to the personal habits of the individual, and varies according to the degree of economy exercised.

Note—In order to meet all the necessary expenses of registration, books, uniform, and other expenditures incident to securing a room and board, a student should come prepared to expend from $65.00 to $75.00 during the first ten days of a semester. After that period his board and room rent will constitute the major part of his expenses.

FELLOWSHIP

The Stillman W. Robinson Fellowship in Engineering, endowed by the late Emeritus Professor of Mechanical Engineering, Stillman W. Robinson, for the encouragement of graduate research in engineering, provides five hundred ($500.00) annually, and is open to graduates in Mechanical, Civil, and Electrical Engineering. Any student to whom this fellowship is awarded must devote his entire time to the work, which shall amount to at least sixteen credit hours per week, of which at least eight shall be in the line of original research or investigation. For one year's work and a satisfactory thesis, a master's degree will be conferred. For two years work, and a satisfactory thesis, a doctor's degree will be conferred. For further information consult or address the Secretary of the College of Engineering.

Consultation. The office hour of the Secretary of the College of Engineering is from 10 to 11 a. m. daily, Room 131, Lord Hall. Students desiring to consult the Secretary in regard to the filing of petitions, changes of courses, or of class cards, adjustment of schedules and similar needs should see him during his office hours.

The Ohio State University Bulletin is published at least twenty times during the year as follows: Monthly in June, July, August, and September, and bi-weekly in October, November, December, January, February, March, April, and May.

PRESS OHIO STATE REFORMATORY

8771
h Z30
THE JOHN CRERAR LIBRARY

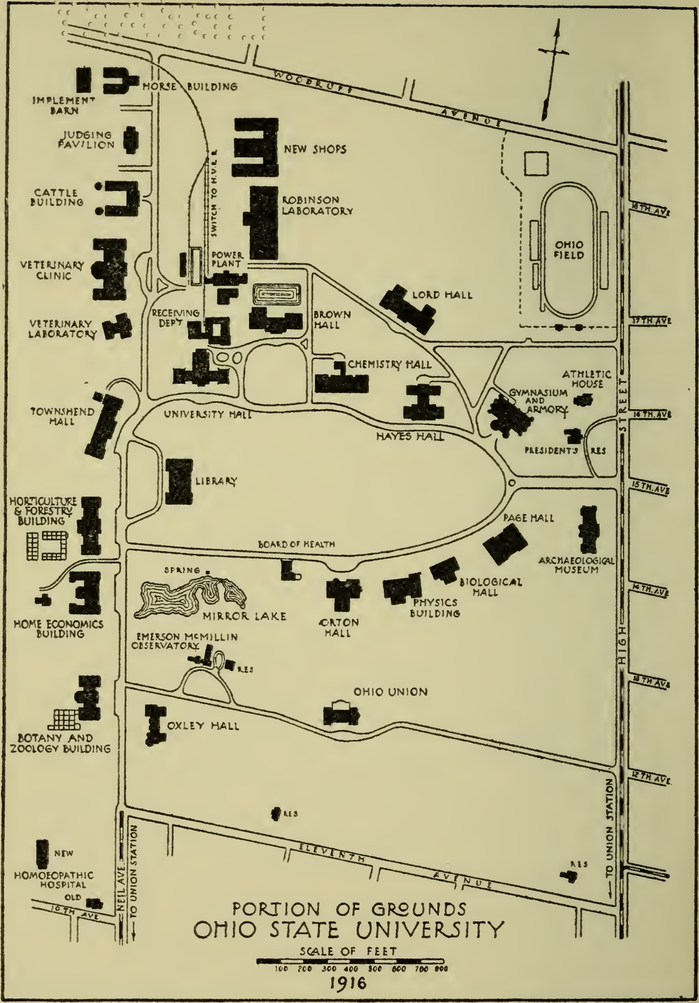
The Ohio State University Bulletin
VOLUME XX FEBRUARY, 1916 NUMBER 19

COLLEGE OF ENGINEERING

1916-1917

PUBLISHED BY THE UNIVERSITY AT COLUMBUS

Entered as second-class matter November 17, 1905, at the Post
Office at Columbus, Ohio, under Act of Congress, July 16, 1894



PORTION OF GROUNDS
OHIO STATE UNIVERSITY

SCALE OF FEET

1916

UNIVERSITY CALENDAR

1916

Entrance examinations, Tuesday to Saturday, June 20 to 24, 8 A. M.

Summer Session, June 19 to August 11.

Entrance examinations, Tuesday to Saturday, September 12 to 16, 8 A. M.

Registration Day—First Semester—Tuesday, September 19.

President's Annual Address, Friday, September 22, 11 A. M.

Latest date for registration of candidates for a degree at the Commencement of June 1917, October 1.

Registration Day, Short Courses in Agriculture—First Term—Tuesday, October 17.

Mid-semester reports to the Deans concerning delinquent students, Wednesday, November 22.

Thanksgiving recess begins November 29, 1 P. M., and ends December 5, 8 A. M.

Christmas recess begins Thursday, December 21, 6 P. M.

1917

Christmas recess ends Wednesday, January 3, 8 A. M.

Registration Day, Short Courses in Agriculture—Second Term—Wednesday, January 3.

Final examinations, Thursday, January 25 to Thursday, February 1.

First semester ends Thursday, February 1, 6 P. M.

Registration Day—Second Semester—Tuesday, February 6.

Washington's Birthday, Thursday, February 22.

Close of Second Term, Short Courses in Agriculture, Friday, March 16.

Mid-semester reports to the Deans, Saturday, March 31.

Easter recess, Thursday, April 5, 6 P. M., to Tuesday, April 10, 8 A. M.

Memorial Day, Wednesday, May 30.

Competitive Drill—Cadet Regiment—Saturday, June 2.

Commencement, Tuesday, June 5.

Final examinations, Wednesday, June 6 to Wednesday, June 13.

Entrance examinations, Tuesday, June 19 to Saturday, June 23, 8 A. M.

ADMINISTRATION

BOARD OF TRUSTEES

Julius F. Stone	Columbus
Guy W. Mallon	Cincinnati
Oscar E. Bradfute	Xenia
Frank E. Pomerene	Coshocton
Benjamin F. McCann	Dayton
John F. Cunningham	Cleveland
John F. Kaiser	Marietta

ADMINISTRATIVE OFFICERS

President . . . . William Oxley Thompson
Office: University Hall—99312; N. 476
Residence: University Grounds—2056

Secretary of the Board of Trustees and Business Manager . . . . Carl E. Steeb
Office: University Hall (East End)—99332; N. 32
Residence: 1956 Iuka Ave.—5835

Registrar, University Editor and Secretary of the University Faculty . . . . Edith D. Cockins
Office: 101 University Hall—99314
Residence: 1348 Neil Ave.—16310

Secretary of the Entrance Board . . . . Lester E. Wolfe
Office: 107 University Hall—99353; N. 939
Residence: 1546 Neil Ave.

Executive Clerk . . . . Katharine H. Duncan
Office: University Hall—99312; N. 476
Residence: The Normandie—5026

Cashier . . . . Bess C. Watters
Office: University Hall (East End)—99332; N. 32
Residence: 1851 N. Fourth St.—N. 2108

COLLEGE OF ENGINEERING

Dean . . . . *Edward Orton, Jr.
Office: 131 Lord Hall—99331
Residence: 629 E. Broad St.—3935

Secretary . . . . Charles C. Morris
Office: 131 Lord Hall—99331
Residence: 149 E. Frambes Ave.—11079

---

*Resigned.

THE TEACHING STAFF

PROFESSORS

Rosser Daniel Bohannan, B. Sc., C. E., E. M. . .226 Sixteenth Avenue
Professor of Mathematics

Benjamin Lester Bowen, Ph. D., Litt. D. . . . . . . 775 East Broad Street
Professor of Romance Languages and Literature

Joseph Villiers Denney, M. A. . . . . 190 West Eleventh Avenue
Professor of English and Dean of the College of Arts, Philosophy and Science

Edward Orton, Jr., E. M. . . . . 629 East Broad Street
Research Professor of Ceramic Engineering

William Thomas Magruder, M. E. . . . . 342 West Ninth Avenue
Professor of Mechanical Engineering

William McPherson, M. Sc., D. Sc., Ph. D. . . . . . 198 Sixteenth Avenue
Professor of Chemistry and Dean of the Graduate School

Joseph Nelson Bradford, M. E. . . . . 1702 North High Street
Professor of Architecture and University Architect

Henry Curwen Lord, B. Sc. . . . . University Campus
Professor of Astronomy and Director of the Emerson McMillen Observatory

Frank Edwin Sanborn, S. B. in M. E. . . . . 90 Fourteenth Avenue
Professor of Industrial Arts and Director of the Department

Frank Arnold Ray, E. M. . . . . 515 Huntington Bank Building
Professor of Mine Engineering

George L. Converse, Captain U. S. A. (Retired) . . . . 1463 Neil Avenue
Professor of Military Science and Tactics

Francis Cary Caldwell, B. A., M. E. . . . . 206 Sixteenth Avenue
Professor of Electrical Engineering

Charles Smith Prosser, M. Sc., D. Sc., Ph. D. . . . . 114 West Tenth Avenue
Professor of Geology

John Adams Bownocker, D. Sc. . . . . 185 Fifteenth Avenue
Professor of Inorganic Geology and State Geologist of Ohio

Alfred Dodge Cole, M. A. . . . . 1648 Neil Avenue
Professor of Physics

Christopher Elias Sherman, C. E.............141 Thirteenth Avenue
Professor of Civil Engineering

Frank Harvey Eno, B. Sc., C. E...............222 Sixteenth Avenue
Professor of Municipal Engineering

James Ellsworth Boyd, M. Sc ....188 East Frambes Avenue
Professor of Mechanics

Thomas Ewing French, M. E...............1458 Worthington Street
Professor of Engineering Drawing

H. Shindle Wingert, M. D.......... ...High and Fifteenth Avenues
Professor of Physical Education

George Washington McCoard, M. A...............1478 Neil Avenue
Professor of Mathematics

William Edwards Henderson, Ph. D.. ....2043 Iuka Avenue
Professor of Inorganic and Physical Chemistry

Charles A. Bruce, B. A.......................1981 Indianola Avenue
Professor of Romance Languages

Charles William Foulk, B. A..................... 384 King Avenue
Professor of Analytical Chemistry

Matthew Brown Hammond, M. L., Ph. D....1481 Michigan Avenue
Professor of Economics and Sociology

Karl Dale Swartzel, M. Sc........................1952 Iuka Avenue
Professor of Mathematics

Harry Waldo Kuhn, Ph. D . .. .Grandview Heights
Professor of Mathematics

Clyde Tucker Morris, C. E ....2043 Iuka Avenue
Professor of Structural Engineering

Edward Elsworth Somermeier, G. Ph........31 Seventeenth Avenue
Professor of Metallurgy

Samuel Jackson Barnett, Ph. D...........241 West Eleventh Avenue
Professor of Physics

William Lloyd Evans, M. Sc., Ph. D ...81 South Champion Avenue
Professor of Chemistry

Marshall Blakemore Evans, Ph. D.......... 38 East Twelfth Avenue
Professor of German

Alan Estis Flowers, M. E. in E. E., M. M. E., Ph. D...........
.... 1634 Neil Avenue
Professor of Electrical Engineering

Edwin F. Coddington, C. E., M. Sc., Ph. D...426 Fifteenth Avenue
Professor of Mechanics

Robert F. Earhart, Ph. D ... . 371 West Tenth Avenue
Professor of Physics

James Renwick Withrow, B. Sc. (Chem.), Ph. D................
....................................77 East Sixteenth Avenue
Professor of Chemistry

Berthold August Eisenlohr, M. A............. 250 Twentieth Avenue
Professor of German

Frederic Columbus Blake, Ph. D....... ....2107 Iuka Avenue
Professor of Physics

Edgar Schugert Ingraham, Ph. D.... ....
Professor of Romance Languages

Samuel Eugene Rasor, M. A., M. Sc...............1594 Neil Avenue
Professor of Mathematics

Charles St. John Chubb, Jr., C. E. (Arch.).... .315 Sixteenth Avenue
Professor of Architecture

Dana James Demorest, B. Sc. in Chem. Engr..372 Fourteenth Avenue
Professor of Metallurgy

Franklin Wales Marquis, B. Sc. in M. E., M. E.. ....
.... 412 West Eighth Avenue
Professor of Steam Engineering

Lynn Wilbur St. John, B. Ph......... ....168 Twelfth Avenue
Professor of Competitive and Recreative Athletics

John Woodworth Wilce, B. A.......... ....70 Twelfth Avenue
Professor of Competitive and Recreative Athletics

Frank Riley Castleman, B. Sc............. 113 East Norwich Avenue
Professor of Competitive and Recreative Athletics

Arthur S. Watts.......................... ... 1835 Indianola Avenue
Professor of Ceramic Engineering

Charles C. Morris, M. A.. ....149 East Frambes Avenue
Professor of Mathematics

Charles F. Kelley, B. A ....1951 Summit Street
Professor of Art

ASSOCIATE PROFESSORS

Charles Lincoln Arnold, M. Sc ....328 West Eighth Avenue
Associate Professor of Mathematics

William Abner Knight, M. E...............206 West Lane Avenue
Associate Professor of Machine Shop Practice

Horace Judd, M. E., M. Sc....................281 Thirteenth Avenue
Associate Professor of Experimental Engineering

Edmund Sewall Manson, Jr., M. Sc..........21 Eighteenth Avenue
Associate Professor of Astronomy

ASSISTANT PROFESSORS

Alpheus Wilson Smith, M. A., Ph. D. ....306 Sixteenth Avenue
Assistant Professor of Physics

Wells Hammond Minor, E. M...............132 West Tenth Avenue
Assistant Professor of Mine Engineering

John Bowker Preston, M. A...................290 Fifteenth Avenue
Assistant Professor of Mathematics

Robert Meiklejohn, M. E ....419 West Ninth Avenue
Assistant Professor of Engineering Drawing

May Thomas, Ph. D.......... ....233 West Eleventh Avenue
Assistant Professor of German

Grace Bareis, Ph. D.................. ....201 West Eleventh Avenue
Assistant Professor of Mathematics

Theodore Ely Hamilton, M. A., Ph. D.............319 King Avenue
Assistant Professor of Romance Languages

Sarah Tracy Barrows, M. L...................1806 North High Street
Assistant Professor of German

Edwin Long Beck, M. A.................... 230 West Tenth Avenue
Assistant Professor of English

Thomas McDougal Hills, B. Ph................. ..... 1942 Iuka Avenue
Assistant Professor of Geology

Carl Joseph West, M. A., Ph. D ....52 East Woodruff Avenue
Assistant Professor of Mathematics

William John McCaughey, B. Sc. (Chem.), Ph. D.......... ..
....108 East Frambes Avenue
Assistant Professor of Metallurgy and Mineralogy

Ludwig Lewisohn, M. A., Litt. D...........220 West Tenth Avenue
Assistant Professor of German

Robert Oscar Busey, M. A.............................. 2090 Iuka Avenue
Assistant Professor of German

George S. Chapin, M. A....................55 East Woodruff Avenue
Assistant Professor of Romance Languages

Carl C. Harrop, E. M........................2326 Indianola Avenue
Assistant Professor of Ceramic Engineering

William S. Hindman, C. E ....1961 Summit Street
Assistant Professor of Civil Engineering

Cecil E. Boord, M. A., Ph. D..................1310 Forsythe Avenue
Assistant Professor of Chemistry

Victor A. Ketcham, B. A., LL. B............47 East Patterson Avenue
Assistant Professor of English

Walter Peirce, M. A., Ph. D ....1485 Pennsylvania Avenue
Assistant Professor of Romance Languages

George F. Schlesinger, C. E...................16 Thirteenth Avenue
Assistant Professor of Civil Engineering

Cree Sheets, C. E. (Arch.)....................59 East Lane Avenue
Assistant Professor of Engineering Drawing

John W. Shipley, M. A., Ph. D.............384 East Oakland Avenue
Assistant Professor of Chemistry

Owen E. Williams...............................2094 Tuller Street
Assistant Professor of Engineering Drawing

Clarence E. Andrews, Ph. D..................1874 North High Street
Assistant Professor of English

Milton Percival, Ph. D......................289 Eighteenth Avenue
Assistant Professor of English

Roscoe C. Sloane, B. Ph., C. E.....................25 University Place
Assistant Professor of Civil Engineering

William D. Turnbull, C. E................151 East Oakland Avenue
Assistant Professor of Engineering Drawing

INSTRUCTORS

Frank H. Haskett ....380 King Avenue
Instuctor in Architecture

Wilbert C. Ronan, C. E. (Arch.), B. Sc. (Arch.)....47 Twelfth Avenue
Instructor in Architecture

William J. Norris.........................60 East Eighth Avenue
Instructor in Art

Robert C. Hummel, M. A. ....139 West Ninth Avenue
Instructor in Chemistry

Arthur D. Kilmer, C. E.....................122 West Third Avenue
Instructor in Civil Engineering

Wilhelm Neilson, B. Sc. in C. E...................1961 Summit Street
Instructor in Civil Engineering

Charles S. Carroll, C. E...... ....72 Chittenden Avenue
Instructor in Civil Engineering

John E. Shepardson, B. Sc. ....2144 Neil Avenue
Instructor in Electrical Engineering

Roy A. Brown, M. E. in E. E....................2074 Peasley Street
Instructor in Electrical Engineering

Edward J. Gilbert, M. E.. . ...66 Chittenden Avenue
Instructor in Engineering Drawing

Carl L. Svensen, B. Sc.................... ......1565 Hunter Street
Instructor in Engineering Drawing

J. Forest Craig, M. A......................... 191 Fifteenth Avenue
Instructor in English

Charles G. Dishong, B. Sc. (Edu.), M. A.....75 West Tenth Avenue
Instructor in English

Earl W. Wiley, B. A...................... ....438 King Avenue
Instructor in English

Theodore F. Kotz, M. A.......... ....2178 Summit Street
Instructor in German

Heinrich C. Keidel, Ph. D...................196 West Sixth Avenue
Instructor in German

Heinrich W. Reese, B. A.........................1606 Neil Avenue
Instructor in German

Allando A. Case............. ....194 West Ninth Avenue
Instructor in Industrial Arts

Clement M. Beem...........................173 Fourteenth Avenue
Instructor in Industrial Arts

Jacob A. Foust...........................21 West Frambes Avenue
Instructor in Industrial Arts

Ulysses W. Denman. ....505 Chilcote Avenue
Instructor in Industrial Arts

Aubrey I. Brown, M. E......................210 Thirteenth Avenue
Instructor in Mechanical Engineering

Henry C. Ohlson........................16 West Tenth Avenue
Instructor in Physical Education

Allison W. Marsh, B. A..................34 West Frambes Avenue
Instructor in Physical Education

Dwight A. Woodbury, M. Sc................308 Nineteenth Avenue
Instructor in Physics

Herman C. Heil, B. Ph......................1479 Belmont Avenue
Instructor in Physics

Alva W. Smith, M. A.....................127 East Eleventh Avenue
Instructor in Physics

Jay K. Ditchy, M. A...........................2 Fifteenth Avenue
Instructor in Romance Languages

Alexander P. Moore, M. A...............90 East Fourteenth Avenue
Instructor in Romance Languages

Leopold Cardon.........................93 West Eleventh Avenue
Instructor in Romance Languages

ASSISTANTS

Homer B. Adkins, B. Sc.....................133 West Ninth Avenue
Assistant in Chemistry

Emil H. J. Balz, B. Sc. (Chem. Engr.).........964 South High Street
Assistant in Chemistry

Marion Hollingsworth, B. Sc., B. A.........1562 Worthington Street
Assistant in Chemistry

Carl R. McCroskey, B. A................107 West Eleventh Avenue
Assistant in Chemistry

Claude P. McNeil, M. A.....................1857 Indianola Avenue
Assistant in Chemistry

Edward Schmidt, M. A.......................75 West Tenth Avenue
Assistant in Chemistry

Gebhard Stegeman, B. A.......,........107 West Eleventh Avenue
Assistant in Chemistry

James H. Young, B. Sc........................1614 Highland Street
Assistant in Chemistry

Wilbur C. Dyer, M. E. in E. E..............303 West Ninth Avenue
Assistant in Electrical Engineering

Troi O. Farmer, M. E. in E. E..............50 West Eighth Avenue
Assistant in Electrical Engineering

Samuel S. Withrow..........................417 Eighteenth Avenue
Assistant in Engineering Drawing

Gertrude L. Robinson, B. A.......................Worthington, Ohio
Assistant in English

Marjorie L. McCutcheon, B. Ph..............325 West Tenth Avenue
Assistant in English

Kathryn Roeser, M. A......................169 West Tenth Avenue
Assistant in English

Ernest Rey, B. A.........................167 East Eleventh Avenue
Assistant in German

John J. Breckur.............................195 West Third Avenue
Assistant in Industrial Arts

Perry L. Wright.............................139 West Lane Avenue
Assistant in Industrial Arts

Robert E. Smith....................................Westerville, Ohio
Assistant in Industrial Arts

Harold Wright.................................963 Sullivant Avenue
Assistant in Industrial Arts

Hortense Rickard, M. A....................333 West Tenth Avenue
Assistant in Mathematics

Carlton L. Brown, B. M. E..................22 Seventeenth Avenue
Assistant in Mechanical Engineering

William W. Watson.......................2218½ North High Street
Assistant in Mechanical Engineering

Herman H. Ashinger, B. Sc. in E. E........136 West Tenth Avenue
Assistant in Mechanics

John Milton Strait, M.E. in E. E.................2413 Neil Avenue
Assistant in Physics

Bennett H. Jackson, B. A...................334 West Ninth Avenue
Assistant in Physics

THE OHIO STATE UNIVERSITY

The Ohio State University, located in Columbus, is a part of the public educational facilities maintained by the State.

ORGANIZATION

For convenience of administration, the departments of the University are grouped into organizations called colleges. The Ohio State University comprises eleven colleges and a graduate school, each under the administration of a Dean and College Faculty, as follows:

- Graduate School
- College of Agriculture
- College of Arts, Philosophy and Science
- College of Commerce and Journalism
- College of Dentistry
- College of Education
- College of Engineering
- College of Homoeopathic Medicine
- College of Law
- College of Medicine
- College of Pharmacy
- College of Veterinary Medicine

Summer Session

In addition to the above, there is a Summer Session under the supervision of a Director and governing committee for the administration of the regular University courses offered in the summer.

This bulletin of announcements is devoted exclusively to the work of the College of Engineering, offered during the academic year beginning September, 1916.

(*Note*—The University publishes a bulletin descriptive of each college. Copies may be obtained by addressing L. E. Wolfe, Secretary of the Entrance Board, Ohio State University, Columbus, Ohio, and stating the college in which the writer is interested.)

THE COLLEGE OF ENGINEERING

The purpose of the College of Engineering is to instruct students in the fundamental sciences and arts, upon which all engineering rests, and to impart such special and technical knowledge of the various branches of engineering as will enable its graduates to enter them and maintain themselves while gaining their professional experience. To accomplish this purpose, the work of the College is classified under nine curricula, which are described on the following pages and which lead to the following degrees:

Bachelor of Architecture (B. Arch.)
Bachelor of Architectural Engineering (B. Arch. E.)
Bachelor of Ceramic Engineering (B. Cr. E.)
Bachelor of Chemical Engineering (B. Ch. E.)
Bachelor of Civil Engineering (B. C. E.)
Bachelor of Electrical Engineering (B. E. E.)
Bachelor of Mechanical Engineering (B. M. E.)
Bachelor of Engineering in Mining (B. E. M.)
Bachelor of Engineering (B. E.)

The curriculum leading to the degree of B. E. is offered for the benefit of those students who may desire instruction not included in any one of the special curricula, and also for those who may wish an opportunity to pursue a limited number of cultural studies, together with elective engineering studies. It is believed, however, that the severe mental discipline of any of these curricula makes the work of the College of Engineering the equal of any other in general educational value.

FIVE-YEAR CURRICULUM

For the benefit of those who are unable to carry the full schedule, on account of outside work for self-support, impaired health, or any other valid reason, any of the regular curricula can be rearranged to cover five instead of four years.

COMBINATION CURRICULA

It is also possible to arrange combination curricula leading to two degrees in five or more years. (See page 26)

GRADUATE COURSES

Advanced courses in various engineering subjects are offered, by the Departments of the College of Engineering, to those who wish to pursue them. If such courses are pursued with the expectation of receiving credit upon them to apply towards any higher degree, the student must register in the Graduate School, under whose jurisdiction all work for the higher degrees is conducted. For further information, consult the bulletin of the Graduate School of the University or confer with the Dean or Secretary.

TWO-YEAR CURRICULA

The following two-year or short curricula, do not lead to a degree, but students completing them are furnished a formal certificate stating the work they have accomplished:

Clay-working
Industrial Arts
Mining

ADMISSION

The college is open on equal terms to both sexes. Applicants for admission must be at least seventeen years of age.

THE ENTRANCE BOARD

The admission of students to the University is in charge of the Entrance Board, which determines the credit that shall be issued on all entrance examinations and certificates, and furnishes all desired information to applicants. Correspondence relating to admission should be addressed to the Secretary of the Entrance Board, Ohio State University, Columbus, Ohio.

REQUIREMENTS

To obtain full standing in the College of Engineering, an applicant under twenty-one years of age must be a graduate of a high school of the first grade or must receive credit by examination for fifteen units.

Of these fifteen units, not less than three shall be in English; three in mathematics (including solid geometry); one in physics; four in languages (other than English); and four shall be elective, and may include any subject given by any first-grade high school.

In case of schools in which manual training is especially recommended, two units of foreign language may be replaced by two units of manual training or mechanical drawing.

No student under twenty-one years of age will be admitted to college if he is conditioned in more than two of the fifteen units. An applicant twenty-one years of age or over may be admitted with a total deficiency of four units. Of these four units, all may be in foreign language, but not more than two units may be in subjects other than foreign language.

The requirements for admission to the College of Engineering are stated in detail in the *Bulletin of General Information*.

For admission by examination see page 26; by certificate see page 27 of the *Bulletin of General Information*.

ADMISSION TO SHORT CURRICULA

Applicants must be at least seventeen years of age and unless they are over twenty-one years of age must have credit by examination or certificate for the common branches. In addition, each applicant under twenty-one years of age must present a letter or certificate showing that he has at least two years' consecutive practical experience in some industry related to the course which he wishes to pursue, and this certificate must be satisfactory to the Executive Committee of the College of Engineering.

CURRICULA

OUTLINE OF THE FIRST YEAR'S WORK OF ALL FOUR-YEAR CURRICULA

In order to permit all engineering students to have a year in which to find out definitely what courses they desire to pursue, the first year of all engineering curricula except Architecture, is made uniform. While students are asked to indicate their choice on entering the College, they can change at the end of the first year without any inconvenience.

Note—The figure in parenthesis following the name of each study indicates the number of the study in its department; the other figure indicates the number of credit hours.

First Semester		Second Semester	
Mathematics (131) College Algebra and Trigonometry	5	Mathematics (132) Trigonometry and Analytics	5
Chemistry (105 or 109)* General Chemistry	4	Chemistry (106 or 110)* General Chemistry and Qualitative Analysis	4
Modern Language French, German or Spanish	4	Modern Language French, German or Spanish	4
English (101) Paragraph Writing	2	English (104) Paragraph Writing	2
Engineering Drawing (101) Elementary Mechanical	2	Engineering Drawing (102) Lettering and Projections	3
Military Drill	1	Military Drill	1
Physical Education	1	Physical Education	1

SUMMER SESSION

Shopwork is required in the Summer Session in all Engineering curricula except Architecture and Civil Engineering. In Electrical, Mechanical, and Mine Engineering, the shopwork courses (109) and (115) are required at the end of the first year. In Chemical Engineering, the same courses are required, but may be taken at the end of the first or second year. In Ceramic Engineering and in General Engineering, Shopwork (107), (109), and (115) are offered and two of these must be taken at the end of the first year.

---

*Students presenting Chemistry as an entrance subject will take Chemistry 109 and 110. Students with no entrance credits in Chemistry will take Chemistry 105 and 106.

ARCHITECTURE

FIRST YEAR

FIRST SEMESTER			SECOND SEMESTER		
Mathematics College Algebra and Trigonometry	(131)	5	Mathematics Trigonometry and Analytics	(132)	5
French	(101 or 103)	4	French	(102 or 106)	4
English Paragraph Writing	(101)	2	English Paragraph Writing	(104)	2
Engineering Drawing Elementary Mechanical	(101)	2	Engineering Drawing Lettering and Projections	(102)	3
Art Elementary Drawing	(131)	2	Art Elementary Drawing	(132)	2
Architecture Elements of Architecture	(131)	2	Architecture Elements of Architecture	(132)	2
Military Drill		1	Military Drill		1
Physical Education		1	Physical Education		1

SECOND YEAR

Mathematics Calculus	(127)	3	Mathematics Calculus	(128)	3
Physics General Physics	(117)	2	Physics General Physics	(118)	2
Engineering Drawing Descriptive Geometry	(107)	3	Architecture Shades, Shadows and Perspective	(124)	3
Art Advanced Drawing	(133)	2	Art Elementary Design	(141)	2
Architecture History of Architecture	(133)	3	Architecture History of Architecture	(134)	3
Architecture Design	(141)	5	Architecture Design	(142)	5
Military Drill		1	Military Drill		1

SUMMER COURSE—Architecture (120), Architectural Practice, or an Architectural Problem. Four credit hours.

THIRD YEAR

Mechanics Statics and Strength of Materials	(103)	5	Civil Engineering Trusses	(124)	3
Art Water Color	(161)	2	Art Advanced Water Color	(162)	2
Architecture Architectural Composition	(113)	2	Architecture Wood Construction	(150)	5
Architecture Photography	(111)	2	Architecture History of Architecture	(136)	3
Architecture History of Architecture	(135)	2	Architecture Design	(144)	5
Architecture Design	(143)	5			

SUMMER COURSE—Architecture (121), Architectural Practice, or an Architectural Problem. Four credit hours.

FOURTH YEAR

FIRST SEMESTER			SECOND SEMESTER		
Mechanical Engineering Heating and Ventilating	(121)	3	Civil Engineering Cement and Concrete	(130)	2
Architecture Plumbing	(117)	1	Architecture Professional Practice	(116)	4
Architecture Masonry	(151)	3	Architecture Thesis	(118)	5
Architecture Ornament	(147)	4	Architecture Design	(146)	5
Architecture Design	(145)	5	Art Drawing from Life	(164)	2
Art Drawing from Life	(163)	2			

ARCHITECTURAL ENGINEERING

FOR FIRST YEAR, SEE PAGE 15

SECOND YEAR

FIRST SEMESTER			SECOND SEMESTER		
Mathematics Calculus	(141)	5	Mathematics Calculus	(142)	5
Physics General Physics	(111)	3	Physics General Physics	(112)	3
Engineering Drawing Descriptive Geometry	(107)	3	Architecture Shades, Shadows and Perspective	(124)	3
Architecture Elements of Architecture	(131)	2	Architecture Elements of Architecture	(132)	2
Architecture History of Architecture	(133)	3	Architecture History of Architecture	(134)	3
Art Elementary Drawing	(131)	2	Art Elementary Drawing	(132)	2
Military Drill		1	Military Drill		1

SUMMER COURSE—Architecture (120), Architectural Practice, or an Architectural Problem. Four credit hours.

THIRD YEAR

NOT GIVEN IN 1916-1917

Mechanics Statics & Strength of Materials	(103)	5	Mechanics Strength of Materials	(104)	2
Mechanical Engineering Materials of Construction	(123)	2	Civil Engineering Trusses	(124)	3
Architecture Architectural Composition	(113)	2	Architecture Photography	(111)	2
Architecture History of Architecture	(135)	2	Architecture Wood Construction	(150)	5
Architecture Design	(141)	5	Architecture Design	(142)	5
Electrical Engineering Illumination	(117)	2			

SUMMER COURSE—Architecture (121), Architectural Practice, or an Architectural Problem. Four credit hours.

FOURTH YEAR

NOT GIVEN IN 1916-1917

FIRST SEMESTER			SECOND SEMESTER		
Mechanical Engineering Heating and Ventilating	(121)	3	Civil Engineering Tall Buildings	(125)	3
Mechanical Engineering Experimental Engineering Laboratory	(169)	2	Civil Engineering Cement and Concrete	(130)	2
Civil Engineering Concrete Design	(129)	3	Civil Engineering Surveying	(128)	2
Architecture Plumbing	(153)	2	Architecture Professional Practice	(116)	4
Architecture Masonry	(151)	3	Architecture Thesis	(118)	5
Architecture Design	(143)	5	Architecture Fire Protection	(123)	2

CERAMIC ENGINEERING

FOR FIRST YEAR, SEE PAGE 15

SECOND YEAR

FIRST SEMESTER			SECOND SEMESTER		
Mathematics Calculus	(141)	5	Mathematics Calculus	(142)	5
Physics Mechanics and Heat	(111)	3	Physics Electricity, Light and Sound	(112)	3
Engineering Drawing Descriptive Geometry	(103)	3	Engineering Drawing Machine Sketching	(104)	3
Ceramic Engineering Ceramic Chemistry	(101)	4	Ceramic Engineering Laboratory	(102)	4
Ceramic Engineering Clays	(141)	3	Ceramic Engineering Clay Wares	(142)	3
Military Drill		1	Military Drill		1

THIRD YEAR

Mechanics Statics & Strength of Materials	(101)	5	Mechanics Strength of Materials	(104)	2
Chemistry Physical Chemistry	(157)	3	Chemistry Physical Chemistry	(158)	3
Mine Engineering Mine Surveying	(103)	4	Civil Engineering Trusses	(124)	3
Ceramic Engineering Drying and Burning	(143)	3	Ceramic Engineering Decoration of Clay Wares	(144)	3
Ceramic Engineering Calculations	(105)	2	Ceramic Engineering Phys. Chem. Measurements	(108)	3
Mine Engineering Mine Trip	(109)	1	Mechanical Engineering Mechanism and Design	(110)	3

FOURTH YEAR

Ceramic Engineering (111) Laboratory	5	*Ceramic Engineering (112) Laboratory	5
Ceramic Engineering (113) Drawing	5	Ceramic Engineering (114) Drawing	5
Geology (165) General Geology	3	*Ceramic Engineering (118) Cement Lectures	5
Metallurgy (117) Fuel	2	Civil Engineering (118) Cement and Concrete	3
Metallurgy (119) Iron and Steel	2	Ceramic Engineering (116) Thesis	4

CHEMICAL ENGINEERING

FOR FIRST YEAR, SEE PAGE 15

SECOND YEAR

FIRST SEMESTER		SECOND SEMESTER	
Mathematics (141) Calculus	5	Mathematics (142) Calculus	5
Physics (111) General Physics	3	Physics (112) General Physics	3
Engineering Drawing (103) Descriptive Geometry	3	Engineering Drawing (104) Machine Sketching	3
Chemistry (119) Quantitative Analysis	4	Chemistry (120) Quantitative Analysis	4
Chemistry (113) Advanced General Chemistry	2	Chemistry (114) Advanced General Chemistry	2
		Chemistry (124) Chemical Problems	1
Military Drill	1	Military Drill	1

THIRD YEAR

Mechanics (101) Statics & Strength of Materials	5	Mechanics (102) Kinetics and Hydraulics	
Engineering Drawing (121) Technical Drawing	2	Engineering Drawing (122) Technical Drawing	25
Metallurgy (117) Fuel	2	Mineralogy (102) Mineralogy and Crystallography	3
Metallurgy (119) Iron and Steel	2	Chemistry (152) Organic Chemistry, lecture	2
Chemistry (151) Organic Chemistry, lecture	2	Elective (See foot note.)	5 to 7
Chemistry (153) Organic Chemistry, laboratory	2		
Mechanical Engineering (103) Steam Power Plants	3		

---

*Alternative courses. One must be taken.

Electives in third year, second semester, must be chosen from the following courses, subject to approval of the departments concerned, Chemistry (136) 2, Chemical Literature; Chemistry (154) 2 or 3, Advanced Organic Chemistry; Chemistry (168) 3 to 5, Advanced Qualitative Analysis; Chemistry (176) 3, Sanitary Analysis; Chemistry (187) 2 or 3, Inorganic Preparations; Chemistry (192) 2, Rare Elements; (given only in odd numbered years); Metallurgy (110) 4, General Metallurgy; Metallurgy (112) 2, Calorimetry and Mine Gas Analysis.

FOURTH YEAR

Mechanical Engineering Machine Design	(127)	5	Mechanical Engineering Machine Design	(144)	5
Chemistry Physical Chemistry	(157)	3	Chemistry Physical Chemistry	(158)	3
Chemistry Industrial Chemistry	(177)	2	Chemistry Industrial Chemistry	(178)	1
Chemistry Industrial Chemistry, laboratory	(185)	2	Chemistry Industrial Chemistry, laboratory	(186)	3
Electrical Engineering Elementary Electrical Engineering	(101)	5	Chemistry Thesis	(140)	4
			Chemistry Inspection Trip	(182 or 184)	1
			Elective		2

CIVIL ENGINEERING

FOR FIRST YEAR, SEE PAGE 15

SECOND YEAR

FIRST SEMESTER			SECOND SEMESTER		
Mathematics Calculus	(141)	5	Mathematics Calculus	(142)	5
Physics General Physics	(111)	3	Physics General Physics	(112)	3
Engineering Drawing Descriptive Geometry	(105)	3	Engineering Drawing Advanced Descriptive Geom.	(106)	3
Civil Engr. Land Surveying & Field Practice	(101 and 101a)	4 and 1	Civil Engr. R. R. Surveying & Field Practice	(102 and 102a)	3 and 1
Civil Engineering Topographic Drawing	(103)	2	Geology General Geology	(168)	3
Military Drill		1	Military Drill		1

SUMMER COURSES—Civil Engineering (104 and 111), each four weeks of six days per week. Four credit hours for each course. Field work in Surveying. Required in second and third years respectively.

THIRD YEAR

Astronomy Geodesy and Least Squares	(104)	3	Astronomy Geodesy and Least Squares	(105)	3
Mechanics Statics and Strength of Materials	(101)	5	Mechanics Kinetics and Hydraulics	(102)	5
Civil Engineering Topographic Surveying	(105)	3	Civil Engineering Timber Construction	(108)	3
Civil Engineering Stereotomy	(107)	3	Civil Engineering Roads and Streets	(106)	3
Civil Engineering Sanitary Engineering	(109)	2	Civil Engineering Stresses in Structure	(110)	4
Architecture Photography	(111)	2			

FOURTH YEAR

Civil Engineering Bridge Design	(113)	4	*Civil Engineering Advanced Bridges	(114)	4
Civil Engineering Cement and Concrete	(118)	3	*Civil Engineering Railways	(112)	4
Civil Engineering Masonry Construction	(115)	3	Civil Engineering Masonry Structure	(116)	3
Electrical Engineering	(103)	3	Civil Engineering Water Supply	(117)	3
Machanical Engineering Laboratory	(173)	5	Civil Engineering Contracts and Specifications	(120)	2
Civil Engineering Thesis	(119)	1	Mechanical Engineering Mechanism and Mach. Design	(140)	2
			Civil Engineering Thesis	(122)	4
			Mech. Eng. (Elective)	(150)	3

ELECTRICAL ENGINEERING

FOR FIRST YEAR, SEE PAGE 15

SECOND YEAR

FIRST SEMESTER			SECOND SEMESTER		
Mathematics Calculus	(141)	5	Mathematics Calculus	(142)	5
Physics Mechanics and Heat	(113)	5	Physics Electricity, Light and Sound	(114)	5
Engineering Drawing Descriptive Geometry	(103)	3	Physics Laboratory	(134)	3
Physics Laboratory	(133)	2	Engineering Drawing Machine Sketching	(110)	2
Shopwork Machine Work	(119)	3	Shopwork Advanced Machine Work	(121)	3
Military Drill		1	Military Drill		1

THIRD YEAR

Mechanics Statics & Strength of Materials	(101)	5	Mechanics Kinetics and Hydraulics	(102)	5
Physics Laboratory	(135)	5	Electrical Engineering D. C. Machinery	(104)	5
Mechanical Engineering Heat Power Engineering	(105)	3	Mechanical Engineering Heat Power Engineering	(106)	3
Mechanical Engineering Mechanism	(101)	3	Mechanical Engineering Laboratory	(160)	2
Engineering Drawing Technical	(111)	2	Electrical Engineering Applications, A. C. Prin.	(106 & 108)	3
Electrical Engineering Inspection Trip	(131)				

---

*Alternative courses. One must be taken.

FOURTH YEAR

Mechanical Engineering Laboratory	(175)	3	Electrical Engineering A. C. Laboratory	(112)	3
Electrical Engineering A. C. Laboratory	(111)	3	Electrical Engineering Transmission	(124)	3
Electrical Engineering A. C. Machinery	(109)	3	Industrial Arts Machine Design	(112)	2
Electrical Engineering Elec. Machine Design	(121)	3	Electrical Engineering Thesis	(128)	5
Electrical Engineering Thesis	(127)	1	Electrical Eng'ring Inspection Trip	(130) or (134)	
Electrical Engineering	(*)	2			
Elective	2 to	4	Elective	2 to	5

---

*One of the following: (113) Railways, (115) Telephones, (117) Illumination, (119) Wireless Telegraphy.

GENERAL ENGINEERING

FOR FIRST YEAR, SEE PAGE 15

SECOND YEAR

FIRST SEMESTER			SECOND SEMESTER		
Mathematics Calculus	(141)	5	Mathematics Calculus	(142)	5
Chemistry Quantitative Analysis	(119)	4	†Chemistry Quantitative Analysis	(120)	4
Physics	(113)	5	Physics	(114)	5
Engineering Drawing	(103)	3	†Physics	(136)	4
Military Drill		1	Engineering Drawing	(104)	3
			Military Drill		1

†Alternative courses. One must be taken.

(1) In addition to the two years outlined above, the student shall obtain credit for 68 semester hours in order to complete the requirements for his degree.

(2) Of these 68 hours, 10 hours must be Mechanics 101 and 102, which shall ordinarily be completed during the third year.

(3) At least 20 hours shall be selected from technical engineering subjects, and 20 hours shall be selected from either technical engineering subjects or from those sciences fundamental to engineering which are included in the Bulletin of the College of Engineering. These subjects must be approved by the engineering department in which the student's principal work is done, and by the Secretary of the College of Engineering.

(4) The production of a thesis shall be optional with the student, subject to the approval of the department concerned.

(5) The remaining 18 hours shall be selected from any work of the University to which the student is eligible, subject to the approval of the Engineering Department having supervision over the last two years of the student's work.

MECHANICAL ENGINEERING

FOR FIRST YEAR, SEE PAGE 15

SECOND YEAR

FIRST SEMESTER		SECOND SEMESTER	
Mathematics (141) Calculus	5	Mathematics (142) Calculus	5
Physics (113) Mechanics and Heat	5	Physics (112) Electricity and Light	3
Engineering Drawing (103) Descriptive Geometry	3	Engineering Drawing (104) Machine Sketching	3
Shopwork (105) Foundry	2	Shopwork (119) Machine Work	3
Shopwork (107) Chipping and Filing	2	Physics (138) Laboratory	2
Shopwork (111) Advanced Pattern Making	1	Civil Engineering (128) Surveying	2
Military Drill	1	Military Drill	1

THIRD YEAR

Mechanics (101) Statics & Strength of Materials	5	Mechanics (102) Kinetics and Hydraulics	5
Engineering Drawing (111) Technical Drawing	2	Architecture (111) Photography	2
Metallurgy (117) Fuel	2	Civil Engineering (126) Timber and Masonry	2
Metallurgy (119) Iron and Steel	2	Mech. Eng. (114) and (116) 3 and Mechanism and Drawing	1
Mathematics (151) Differential Equations	1	Mech. Eng. (118) and (120) 3 and Steam Engines and Boilers	1
Shopwork (121) Advanced Machine Work	3	Mechanical Engineering (164) Laboratory	2
Mechanical Engineering (103) Steam Power Plants	3		

FOURTH YEAR

Civil Engineering (124) Trusses	3	*Industrial Arts (114) Shop Buildings	2
Electrical Engineering (101) Elementary Elec. Engineering	5	*Mechanical Engineering (146) Steam Turbines	2
Mechanical Engineering (127) Machine Design	5	*Mechanical Engineering (150) Hydraulic Power	3
Mechanical Engineering (125) Gas Engines and Producers	2	Mechanical Engineering (144) Machine Design	5
Mechanical Engineering (129) Thermodynamics	2	Mechanical Engineering (142) Hydraulic Machinery	2
Mechanical Engineering (179) Laboratory	2	Mechanical Engineering (190) Laboratory	6
		Mechanical Engineering (148) Thesis	3
		Mechanical Engineering (130 or 134) Inspection Trip	

---

*Alternative courses. One must be taken.

MINE ENGINEERING

FOR FIRST YEAR, SEE PAGE 15

SECOND YEAR

FIRST SEMESTER			SECOND SEMESTER		
Mathematics Calculus	(141)	5	Mathematics Calculus	(142)	5
Physics General Physics	(111)	3	Physics General Physics	(112)	8
Engineering Drawing Descriptive Geometry	(103)	3	Engineering Drawing Machine Sketching	(104)	3
Chemistry Quantitative Analysis	(119)	3	Metallurgy Laboratory	(106)	4
Mine Engineering Mine Surveying	(103)	4	Mineralogy Mineralogy and Crystallograph	(102)	3
			Mine Engineering Mine Trip	(110)	1
Military Drill		1	Military Drill		1

THIRD YEAR

FIRST SEMESTER			SECOND SEMESTER		
Mechanics Statics & Strength of Materials	(101)	5	Mechanics Kinetics and Hydraulics	(102)	5
Metallurgy Fuel	(117)	2	Metallurgy General Metallurgy	(110)	4
Metallurgy Iron and Steel	(119)	2	Metallurgy Calorimetry, Mine Gas Analysis	(112)	2
Metallurgy Fire Assaying	(105)	3	Mineralogy Determinative Mineralogy	(104)	3
Metallurgy Laboratory	(107)	4	Geology Petrography	(166)	2
Geology General Geology	(165)	3	Civil Engineering Trusses	(124)	3

FOURTH YEAR

FIRST SEMESTER			SECOND SEMESTER		
Mine Engineering General Mining	(105)	5	Mine Engineering General Mining	(106)	5
Metallurgy Metallurgical Construction	(111)	1	Mine Engineering Plans and Specifications	(104)	4
Metallurgy Ore Dressing	(113)	2	Metallurgy Metallography, etc.	(114)	3
Mine Engineering Metallurgical Design	(111)	1	Mechanical Engineering Laboratory	(192)	3
Electrical Engineering	(103)	3	*Mine Engineering Thesis	(116)	3
Geology Economic Geology	(167)	3	*Metallurgy Thesis	(116)	
Architecture Photography	(111)	2			

---

*Alternative courses. One must be taken.

THESIS

As a requisite for graduation each candidate in the College of Engineering must present an acceptable thesis, embodying the results of a special study. The subject of this study must lie within the field of the degree sought. The subject must be filed with the head of the department, under whose direction the work is done, on the official blank provided for the purpose, not later than December 15, of the University year in which the degree is sought. The completed thesis must be submitted to the professor who has directed the work not later than the second Thursday before Commencement Day for final approval.

If the thesis is then approved the student shall deposit two copies of it with the University Editor not later than noon of the Friday before Commencement, and shall pay to the Editor a fee covering the cost of binding the same.

COMBINATION CURRICULA

Combination curricula leading to two engineering degrees, can be arranged for any two of the foregoing degrees. The amount of additional time will be at least thirty semester hours in excess of that required for one, and may be more. In no case will the student be required to take all of the work not common to the two curricula as published.

For instance a joint curriculum, Mechanical and Electrical Engineering, can be taken in five years. Where the curricula are more diverse, such as Civil Engineering, and Mechanical Engineering, six years will be required.

ARTS-ENGINEERING CURRICULA

For the benefit of those who desire to possess the advantage of a wider general culture and a broader foundation than can be given in the limits of a four-year professional curriculum, a combination of three years in the College of Arts, Philosophy and Science and three years in the College of Engineering can be so adjusted as to enable the student to secure the degree of Bachelor of Arts and the appropriate engineering degree.

The College of Engineering desires to establish similar relations with other educational institutions of approved standing in Ohio and elsewhere, by which a student can earn two degrees in five or six years.

GRADUATE WORK

The Graduate School has administrative control of the graduate work in all of the colleges of the University. The conditions under which advanced degrees can be obtained by graduates of the College of Engineering are as follows:

Master's Degree. The degree which will usually be conferred upon candidates whose major work lies in Engineering, will be that of Master of Science, (M. Sc.). The course of study will consist of one major and either one or two minors, at least one of the minors being in a different department from that in which the major is taken. A residence of one year devoted wholly to graduate work is required, but graduates of this University may complete not more than half of the required work at another institution offering equivalent opportunities for study. Except in certain special cases, a satisfactory thesis is required.

Professional Engineering Degrees. Upon nomination by the Faculty of the College of Engineering, the appropriate professional engineering degree of Ceramic Engineer, Chemical Engineer, Civil Engineer, Electrical Engineer, Engineer of Mines, Mechanical Engineer, or Master of Architecture, may be granted to graduates of this University upon any one of the following plans:

First. Four years of acceptable professional experience and an approved thesis.

Second. A Master of Science degree from this University with a major in engineering, followed by two years of acceptable professional experience and an approved thesis.

Third. One year of acceptable professional experience, followed by one year of approved study at this University, with an appropriate engineering major, and an approved thesis.

CURRICULA NOT LEADING TO A DEGREE

The following short curricula of two years each, are offered by the College of Engineering to meet the needs of that class of young men who have for some reason failed to qualify themselves to enter the regular four-year curricula, but whose experience in engineering work has shown them the need of some technical education as a requisite to further progress. These curricula are in no sense a substitute for the regular four-year curricula nor are they designed as preparation for subsequent entrance into the regular curricula. They aim to give an introduction to the fundamentals of engineering only, and in the shortest time consistent with any real educational result.

Applicants for admission to these curricula are required to have at least two years of consecutive practical experience in some branch of the industries related to the one they wish to pursue, and to present a satisfactory certificate to that effect. (See the *Bulletin of General Information*, page 35.)

TWO-YEAR CURRICULA

CLAYWORKING

First Year

First Semester		Second Semester	
Mathematics ....(101) Elementary Algebra	5	Mathematics ....(102) Elementary Algebra	5
Chemistry ....(101) Elementary Chemistry	4	Chemistry.......................(102) Elementary Chemistry and Qualitative Analysis	4
Engineering Drawing.........(113) Freehand and Lettering	4	Engineering Drawing....... (114) Mechanical Drawing	3
Ceramic Engineering... .....(141) Occurrence and Winning of Clays	3	Ceramic Engineering........(142) Preparation and Forming of Clay Wares	3
Military Drill...........	1	Military Drill...	1
Physical Education................	1	Physical Education.......	1

Summer Session—*Students are required to take two of the following subjects: Shopwork (107), (109), and (115), during the Summer Session at the close of the first year.

SECOND YEAR

Ceramic Engineering Ceramic Chemistry	(101)	4	Ceramic Engineering Ceramic Chemistry	(102)	3
Ceramic Engineering Drying & Burning of Clay Wares	(143)	3	Ceramic Engineering Glazing and Decorating of Clay Wares	(144)	3
Ceramic Engineering Calculations	(105)	2	Ceramic Engineering Laboratory	(126)	5
Ceramic Engineering Laboratory	(115)	2	Ceramic Engineering Dryer and Kiln Design	(122)	4
Physics Elementary Physics	(101)	6			
Military Drill		1	Military Drill		1

---

*Upon presentation of reasons satisfactory to the head of the department students may substitute work in a ceramic factory for the above shopwork courses.

INDUSTRIAL ARTS

FIRST YEAR

FIRST SEMESTER			SECOND SEMESTER		
Mathematics Elementary Algebra	(101)	5	Mathematics Elementary Algebra	(102)	5
Mathematics Plane and Solid Geometry	(113)	5	Mathematics Solid Geometry, Trigonometry	(114)	5
Engineering Drawing Freehand and Lettering	(113)	4	Engineering Drawing Mechanical Drawing	(114)	3
Shopwork Pattern Making	(109)	2	Shopwork Advanced Pattern Making	(111)	1
Shopwork Forging	(115)	2	Shopwork Foundry	(105)	2
			Shopwork Chipping and Filing	(107)	2
Military Drill		1	Military Drill		1
Physical Education		1	Physical Education		1

SECOND YEAR

Engineering Drawing Descriptive Geometry	(103)	3	Engineering Drawing Machine Sketching	(104)	3
Chemistry Elementary Chemistry	(101)	4	Chemistry Elementary Chemistry	(102)	4
Physics Elementary Physics	(101)	6	Industrial Arts Machines	(101)	3
Shopwork Machine Work	(119)	3	Industrial Arts Designing	(103)	1
Military Drill		1	Shopwork Advanced Machine Work	(121)	3
			Shopwork Advanced Pattern Making	(130)	3
			Military Drill		1

MINING

FIRST YEAR

FIRST SEMESTER		SECOND SEMESTER	
Mathematics (101) Elementary Algebra	5	Mathematics (102) Elementary Algebra	5
Mathematics (113) Plane and Solid Geometry	5	Mathematics (114) Solid Geometry, Trigonometry	5
Physics (101) Elementary Physics	6	Shopwork (115) Forging	2
		Geology (162) Elementary Physiography	4
Military Drill	1	Military Drill	1
Physical Education	1	Physical Education	1

SECOND YEAR

Engineering Drawing (113) Freehand and Lettering	4	Engineering Drawing (114) Mechanical Drawing	3
Chemistry (101) Elementary Chemistry	4	Geology (164) Elementary Geology	3
Mine Engineering (107) Mine Plans	2	Metallurgy (102) Water Supply and Mine Gases	4
Mine Engineering (101) Mine Surveying	5	Mine Engineering (102) General Mining	5
Military Drill	1	Military Drill	1

DEPARTMENTS OF INSTRUCTION

ARCHITECTURE

Office, 100 Brown Hall

PROFESSORS BRADFORD AND CHUBB,
MR. HASKETT, MR. RONAN

131. Elements of Architecture. Two credit hours. First semester. Architecture, first year; Architectural Engineering, second year. Concurrent with Art 131, Engineering Drawing 101.

132. Elements of Architecture. Two credit hours. Second semester. Architecture, first year; Architectural Engineering, second year. Prerequisite, Architecture 131, and concurrent with Art 132 and Engineering Drawing 102.

133. History of Architecture. Three credit hours. First semester. Architecture and Architectural Engineering, second year. Concurrent, Architecture 131 and Art 131.

134. History of Architecture. Three credit hours. Second semester. Architecture and Architectural Engineering, second year. Prerequisite, Architecture 133.

135. History of Architecture. Two credit hours. First semester. Architecture and Architectural Engineering, third year. Prerequisite, Architecture 134.

History of Renaissance Architecture.

136. History of Architecture. Three credit hours. Second semester. Architecture, third year. Prerequisite, Architecture 135.

History of Modern Architecture.

141. Design. Five credit hours. First semester. Architecture, second year; Architectural Engineering, third year. Prerequisite, Architecture 132.

142. Design. Five credit hours. Second semester. Architecture, second year; Architectural Engineering, third year. Prerequisite, Architecture 141.

150. Wood Construction. Five credit hours. Second semester. Architecture and Architectural Engineering, third year. Prerequisite, Architecture 141 and Mechanics 103.

143. Design. Five credit hours. First semester. Architecture, third year; Architectural Engineering, fourth year. Prerequisite, Architecture 142.

144. Design. Five credit hours. Second semester. Architecture, third year. Prerequisite, Architecture 143.

145. Design. Five credit hours. First semester. Architecture, fourth year. Prerequisite, Architecture 144.

146. Design. Five credit hours. Second semester. Architecture, fourth year. Prerequisite, Architecture 145.

123. Fire Protection. Two credit hours. Second semester. Architectural Engineering, fourth year. Concurrent, Civil Engineering 125.

151. Masonry. Three credit hours. First semester. Architecture and Architectural Engineering, fourth year. Prerequisite, Architecture 150.

147. Ornament. Four credit hours. First semester. Architecture, fourth year. Prerequisite, Architecture 144 and 113.

153. Plumbing. Two credit hours. First semester. Architectural Engineering, fourth year.

111. Photography. Two credit hours. Either semester. Architecture, Architectural Engineering, Mechanical Engineering, and Civil Engineering, third year; Mine Engineering, fourth year. Prerequisite, Chemistry 105, 106, or 109, 110. Mr. Haskett.

113. Principles of Architectural Composition. Two credit hours. First semester, Architecture, third year. Prerequisite, Architecture 134. Mr. Chubb.

116. Professional Practice. Four credit hours. Second semester. Architecture, fourth year. Prerequisite, Architecture 151. Mr. Bradford.

117. Sanitary Plumbing. One credit hour. First semester. Architecture, fourth year. Mr. Bradford.

118. Thesis. Five credit hours. Second semester. Architecture, fourth year. Mr. Bradford, Mr. Chubb, Mr. Ronan.

120. Summer Work. Four credit hours. The equivalent of four weeks of work in an architect's office, or a problem in design assigned by the department. Between the second and third years.

121. Summer Work. Four credit hours. The equivalent of four weeks of work in an architect's office, or a problem in design assigned by the department. Between the third and fourth years.

122. Photography. Two credit hours. Second semester. Prerequisite, Architecture 111. Mr. Haskett.

124. Shades, Shadows, and Perspective. Three credit hours. Second semester. Architecture, second year. Prerequisite, Engineering Drawing 107. Mr. Ronan.

For Graduate courses in this department see the Bulletin of the Graduate School.

ART

Office, 203 Hayes Hall

PROFESSOR KELLEY, MISS ROBINSON, MISS SHEPHERD,
MR. NORRIS, MR. CHRISTENSEN

131-132. Elementary Drawing. Two credit hours. The year. Four laboratory hours each week. Architecture, second year.

This course is designed to develop a thorough knowledge of form and values in black and white, also the use of freehand perspective. Art 131 is given also during the second semester.

133. Advanced Drawing. Two credit hours. Either semester. Four laboratory hours each week. Architecture, third year. Prerequisite, Art 131-132.

This course is designed to give the student some freedom in the use of drawing as a medium of expression. Drawing from the antique and the costume model.

161-162. Water Color. Two credit hours. The year. Architecture, third year. Prerequisite, Art 133.

163-164. Drawing from Life. Two credit hours. The year. Architecture, fourth year.

ASTRONOMY

Office, Emerson McMillin Observatory

PROFESSOR LORD, ASSOCIATE PROFESSOR MANSON

104-105. Astronomy, Geodesy, and Least Squares. Three credit hours. The year. Civil Engineering, third year. Prerequisite, the calculus. Mr. Lord, Mr. Manson.

For Graduate courses in this department see the Bulletin of the Graduate School.

CERAMIC ENGINEERING

Office, 131 Lord Hall

PROFESSORS ORTON AND WATTS, ASSISTANT PROFESSOR HARROP, MR. LYSATT

101. Ceramic Chemistry. Four credit hours. First semester. Ceramic Engineering and Short Clayworking, second year. Prerequisite, Chemistry 106 or 110. Mr. Demorest.

Quantitative analysis of limestone and simple minerals.

102. Ceramic Chemistry. Four credit hours. Second semester. Ceramic Engineering, second year. Prerequisite, Ceramic Engineering 101. Mr. Demorest.

Quantitative analysis of clays, fire-gases, etc.

105. Ceramic Calculations. Two credit hours. First semester. Ceramic Engineering, third year; Short Clayworking, second year. Prerequisite, Ceramics 101. Mr. Harrop.

Calculations involved in blending of ingredients used in ceramic mixtures; determinations of limits of variation in given series; limits of errors; volume calculations; problems in heat.

108. Physical and Chemical Measurements of Clays. Three credit hours. Second semester. Ceramic Engineering, third year. Mr. Watts.

Application of physical chemical laws to fusions of mineral mixtures; determination of melting points; deformation periods; relative viscosity of fused magmas; study of influence of salts on viscosity of slips; etc.

111-112. Laboratory Work in Ceramics. Five credit hours. The year. Ceramic Engineering, fourth year. Prerequisite, Ceramics 108 and 144. Mr. Watts.

Practice in clay testing and measurement of physical properties of clays; the production of bodies made from single clays and of clays with minerals. In each case the bodies are burned and tested. The production of slips, engobes, and glazes, and the study of the methods of coloring.

113-114. Ceramic Designing. Five credit hours. The year. Ceramic Engineering, fourth year. Prerequisite, Ceramics 144. Mr. Harrop.

Designing, estimating cost of, and writing specifications for kilns and dryers.

The work started in Ceramics 113 is extended to the design and equipment of clayworking plants.

115. Laboratory Work in Ceramics. Two credit hours. First semester. Short Clayworking, second year. Concurrent, Ceramics 143. Mr. Watts.

Testing of clays and minerals employed in clay manufacture and in blending of same for ceramic purposes.

116. Thesis. Four credit hours. Second semester. Ceramic Engineering, fourth year.

118. Cement Manufacture. Five credit hours. Second semester. Alternative with Ceramics 112, Ceramic Engineering, fourth year. Prerequisites, Ceramics 102 and 144. Mr. Harrop.

The theory of hydraulicity, the compounding, manufacture, and testing of natural and Portland cements and other hydraulic bodies.

122. Dryer and Kiln Design. Four credit hours. Second semester. Short Clayworking, second year. Prerequisite, Ceramics 105. Mr. Harrop.

A graphic study of dryer and kiln design.

126. Laboratory Work in Ceramics. Five credit hours. Second semester. Short Clayworking, second year. Prerequisite, Ceramics 115. Mr. Watts.

The preparation of slips, engobes, and glazes, and the study of the methods of coloring.

141-142. Ceramic Lectures. Three credit hours. The year. Ceramic Engineering, second year; Short Clayworking, first year. Mr. Harrop.

Origin of clays, constitution, properties, and winning of Ceramic materials. General principles of the preparation and forming of clay wares.

143-144. Ceramic Manufacture. Three credit hours. The year. Ceramic Engineering, third year; Short Clayworking, second year. Mr. Harrop, Mr. Watts.

The drying and burning of clay wares. Glazing and decoration of clay wares.

For Graduate courses in this department see the Bulletin of the Graduate School.

CHEMISTRY

Office, 100 Chemistry Hall

PROFESSORS MCPHERSON, HENDERSON, FOULK, EVANS,
AND WITHROW, ASSISTANT PROFESSORS BOORD
AND SHIPLEY, MR. HUMMEL AND
DEPARTMENT ASSISTANTS

101. Elementary Chemistry. Four credit hours. First semester. One lecture, one quiz, six laboratory hours each week. Short Mining, second year; Short Clayworking, first year. Mr. Evans, Mr. Hummel, Mr. Balz.

A general introductory course on the chemistry of the nonmetals. It is distinctly elementary in character and is arranged for students in short courses only. No credit is allowed for it in the regular four-year courses. Students taking this course should follow with Chemistry 102, second semester.

102. Elementary Chemistry and Qualitative Analysis. Four credit hours. Second semester. Continuation of Chemistry 101. Short Courses. Mr. Evans, Mr. Hummel, Mr. Balz.

A general introductory course on the chemistry of the metals. The laboratory work deals with the elementary principles of qualitative analysis. The course is arranged for students in short courses only. No credit is allowed for it in the regular four-year courses.

105. Elementary Chemistry. Four credit hours. Either semester. One lecture, one quiz, and six laboratory hours each week. Required of first-year students in all four-year courses who have not presented chemistry as an entrance credit. Mr. Evans, Mr. Hummel, Mr. McNeil, Mr. Young.

A general course on the chemistry of the non-metals.

106. Elementary Chemistry and Qualitative Analysis. Four credit hours. Second semester. A continuation of Chemistry 105. Mr. Evans, Mr. Hummel, Mr. McNeil, Mr. Young.

A general course in the chemistry of the metals. The laboratory work accompanying is a general introductory course in qualitative analysis.

109. General Chemistry. Four credit hours. Either semester. One lecture, one quiz, and six laboratory hours each week. Taken by first-year students in all four-year courses who have presented chemistry as an entrance credit. Mr. Evans, Mr. Hummel, Mr. McCrosky, Mr. Schmidt.

A general course on the chemistry of non-metals.

110. General Chemistry and Qualitative Analysis. Four credit hours. Second semester. A continuation of Chemistry 109. Mr. Evans, Mr. Hummel, Mr. McCrosky, Mr. Schmidt.

A general course in the chemistry of the metals. It is more advanced than Chemistry 106. The laboratory work is a general course in qualitative analysis.

113-114. Avanced General Chemistry. Two credit hours. The year. Two lectures each week. Chemical Engineering, second year. Prerequisite, Chemistry 106 or 110. Mr. Henderson.

A course on the fundamental topics of general chemistry designed as a thorough review and extension of the first-year courses.

117. Qualitative Analysis. Three credit hours. First semester. One lecture and six laboratory hours each week. Prerequisite, an acceptable course in general chemistry. Mr. Shipley.

119. Quantitative Analysis. (a) Three credit hours. First semester. One lecture and six laboratory hours each week. Mine Engineering, second year. (b) Four credit hours. First semester. One lecture and nine laboratory hours each week. Chemical Engineering, second year. Prerequisite, Chemistry 106 or 110. It is desirable that this course be accompanied by Chemistry 113. Mr. Foulk, Mr. Shipley.

The elementary principles of gravimetric and volumetric analysis.

120. Quantitative Analysis. Four credit hours. Second semester. One lecture and nine laboratory hours each week. Chemical Engineering, second year. Prerequisite, Chemistry 119. Mr. Foulk, Mr. Shipley.

A continuation of Chemistry 119 with typical analytical methods in gravimetric and volumetric analysis. This course should be accompanied by Chemistry 124. It is desirable that it be accompanied by Chemistry 114.

124. Chemical Problems. One credit hour. Second semester. Chemical Engineering, second year. Mr. Foulk.

Extended practice in the solution of problems pertaining to gravimetric and volumetric analysis. This course is arranged to accompany Chemistry 120.

136. The Reading of Chemical Literature. Two credit hours. Second semester. Chemical Engineering, elective, third year. Prerequisite, one year of German. Mr. Foulk.

The object of this course is to afford practice in the rapid reading of German chemical literature, the selections being made with special reference to the technical terms of the science.

140. Thesis. Four credit hours. Second semester. Chemical Engineering, fourth year. Mr. McPherson, Mr. Henderson, Mr. Withrow, Mr. Foulk, Mr. Evans.

151-152. Organic Chemistry. Two credit hours. The year. Two lectures each week. Chemical Engineering, third year. Prerequisite, Chemistry 114 and 120. Mr. McPherson.

General course in organic chemistry.

153-154. Organic Chemistry. Two or three credit hours. The year. Six or nine laboratory hours each week. Chemical Engineering, third year. Must be accompanied or preceded by Chemistry 151 and 152. Mr. McPherson, Mr. Boord.

A general course in the preparation of typical organic compounds.

157-158. Physical Chemistry. Three credit hours. The year. Three lectures each week. Chemical Engineering, fourth year;

Ceramic Engineering, third year. Prerequisite, Chemistry 114, 120, and 152. Mr. Henderson.

This is a general course in physical chemistry.

161. Physical Chemistry. Two or three credit hours. Either semester. Six or nine laboratory hours each week. Elective. Prerequisite or concurrent, Chemistry 157. Mr. Henderson, Mr. Stegeman.

A laboratory course designed to illustrate the general lecture course 157-158.

165. Quantitative Analysis. Two credit hours. First semester. Two recitations each week. Prerequisite, Chemistry 119-120, or equivalent. Mr. Foulk.

Advanced course. A general survey of the methods of quantitative analysis.

167. Special Methods of Analysis. Three to five credit hours. First semester. One lecture and six to twelve laboratory hours each week. Chemical Engineering, elective, third year. Prerequisite, Chemistry 119-120.

Selections may be made from gas analysis, microchemical analysis and spectrum analysis. Time to be arranged.

168. Qualitative Analysis. Three to five credit hours. Second semester. One lecture, six to twelve laboratory hours each week. Chemical Engineering, elective, third year. Prerequisite, Chemistry 120, or equivalent. Mr. Shipley.

Advanced course. Extended work in general qualitative analysis including the more important of the rare elements.

169. Quantitative Analysis. Three to five credit hours. First semester. One conference and six to twelve laboratory hours each week. Prerequisite, Chemistry 119-120, or equivalent. Mr. Foulk.

Advanced course. A laboratory course in advanced quantitative analysis.

176. Sanitary Analysis. Three credit hours. Second semester. Two lectures and three laboratory hours each week. Chemical Engineering, elective, third year. Prerequisite, Chemistry 120, or equivalent. Mr. Foulk.

The methods of sanitary water analysis and interpretation of results.

177. Industrial Chemistry. Two credit hours. First semester. Two lectures each week. Prerequisite, Chemistry 113-114 and 153. Mr. Withrow.

The principles underlying the application of chemistry to the problems of the industries.

178. Industrial Chemistry. One credit hour. Second semester. One lecture each week. Prerequisite, Chemistry 177. Mr. Withrow.

182. Industrial Inspection Trip. A six-day excursion at a suitable time in connection with Chemistry 177-178 for the inspection of industrial chemical processes in actual operation. The entire expense is about $30. A satisfactory report on the work inspected is required. Mr. Withrow.

184. Written Reports. A course of assigned reading upon some industrial chemical process and a written report of the same. This is a substitute for Chemistry 182, but the substitution is only allowed upon presentation of reasons satisfactory to the instructor in charge. Mr. Withrow.

185. Industrial Chemistry. Two credit hours. First semester. One conference, five laboratory hours each week. Prerequisite, Chemistry 119-120. Prerequisite or concurrent, Chemistry 177. Mr. Withrow.

Industrial chemical research.

186. Industrial Chemistry. Three credit hours. Second semester. One conference, and eight laboratory hours each week. Prerequisite, Chemistry 119-120. Prerequisite or concurrent, Chemistry 177-178. Mr. Withrow.

Industrial chemical research and technical analysis.

187. Inorganic Preparations. Two or three credit hours. Either semester. Six or nine laboratory hours each week. Chemical Engineering, elective, third year. Prerequisite, Chemistry 114 and 120. Mr. Henderson, Mr. Stegeman.

The preparation of a limited number of compounds chosen so as to give practice in the different kinds of manipulation involved in the preparation of inorganic compounds.

192. Rare Elements. Two credit hours. Second semester. Two lectures each week. Elective. Given in 1914-15 and biennially thereafter. Prerequisite, Chemistry 114 and 120. Mr. Henderson.

The chemistry of the rare elements, including a discussion of their increasing economic importance.

194. Applied Electro-Chemistry. Two credit hours. Second semester. Two lectures each week. Elective. Prerequisite or concurrent, Chemistry 158, except by the special permission of the instructor. Mr. Withrow.

The application of the electric current in chemical industries.

For Graduate courses in this department see the Bulletin of the Graduate School.

CIVIL ENGINEERING

Office, 107 Brown Hall

PROFESSORS SHERMAN, ENO AND MORRIS, ASSISTANT
PROFESSORS HINDMAN, SCHLESINGER AND SLOANE,
MR. NEILSON, MR. CARROLL, MR. PERRY

101. Land Surveying. Four credit hours. First semester. Four recitations each week. Civil Engineering, second year. Prerequisite, Mathematics 132, Engineering Drawing 102. Mr. Sherman, Mr. Eno, Mr. Schlesinger, Mr. Sloane.

Care and use of instruments. Farm, city and hydrographic surveying.

101a. Field Practice. One credit hour. First semester. Three hours each week in field. Civil Engineering, second year. Prerequisite or concurrent, Civil Engineering 101. Mr. Schlesinger, Mr. Hindman, and department instructors.

Field exercises in use of instruments and surveying.

102. Railroad Surveying. Three credit hours. Second semester. Three recitations each week. Civil Engineering, second year. Prerequisite, Civil Engineering 101 and 101a. Mr. Sherman, Mr. Schlesinger, Mr. Sloane.

Simple, compound, and transition curves, frogs, switches and earth-work.

102a. Field Practice. One credit hour. Second semester. Three hours each week in field. Civil Engineering, second year. Prerequisite or concurrent, Civil Engineering 102. Mr. Schlesinger, Mr. Sloane, and department instructors.

Field practice in laying out curves, frogs, switches, and earthwork.

103. Topographic Drawing. Two credit hours. First semester. Six hours each week in drafting room. Civil Engineering, second year. Prerequisite, Engineering Drawing 102. Mr. Sherman, Mr. Eno.

Exercises in black ink and color topographic drawing.

104. Summer Surveying Camp. Four credit hours. Civil Engineering, at close of second year. Prerequisite, Civil Engineering 101a and 102a.

Four weeks of six days each of ten hours a day, from the middle of June to the middle of July.

105. Topographic Surveying. Three credit hours. First semester. Nine hours each week in field or drawing room. Civil Engineering, third year. Prerequisite, Civil Engineering 101, 102, and 104. Mr. Schlesinger, Mr. Sloane.

Field and office work in four or five kinds of topographic surveying.

106. Roads and Streets. Three credit hours. Second semester. Three recitations each week. Civil Engineering, third year. Prerequisite, Civil Engineering 102 and 104. Mr. Eno.

107. Stereotomy. Three credit hours. First semester. Recitations, lectures, and drawing. Civil Engineering, third year. Prerequisite, Engineering Drawing 106. Mr. Schlesinger, Mr Sloane.

108. Timber Construction. Three credit hours. Second semester. Lectures and drawing. Civil Engineering, third year. Prerequisite, Engineering Drawing 105; concurrent, Mechanics 102. Mr. Schlesinger, Mr. Sloane.

109. Sanitary Engineering. Two credit hours. First semester. Two recitations each week. Civil Engineering, third year. Prerequisite, Civil Engineering 102 and 104. Mr. Eno.

110. Stresses in Structure. Four credit hours. Second semester. Four recitations each week. Civil Engineering, third year. Prerequisite or concurrent, Mechanics 102. Mr. Morris.

111. Summer Surveying Camp. Four credit hours. Civil Engineering at close of third year. Prerequisite, Civil Engineering 104 and 105.

Four weeks of six days each of ten hours a day, from the middle of June to the middle of July.

112. Railway Location. Four credit hours. Second semester. Four recitations each week. Optional with Civil Engineering 114. Civil Engineering, fourth year. Prerequisite, Civil Engineering 102 and 111 and Mechanics 102. Mr. Sherman.

113. Bridge Designing. Four credit hours. First semester. Four recitations each week. Civil Engineering, fourth year. Prerequisite, Civil Engineering 110. Mr. Morris.

114. Advanced Bridges. Four credit hours. Second semester. Four recitations each week. Optional with Civil Engineering 112. Civil Engineering, fourth year. Prerequisite, Civil Engineering 113. Mr. Morris.

115. Masonry Construction. Three credit hours. First semester. Three recitations each week. Civil Engineering, fourth year. Prerequisite, Civil Engineering 111, Mechanics 102. Mr. Sherman.

116. Masonry Structures. Three credit hours. Second semester. Three recitation, lecture, or drawing periods each week. Civil Engineering, fourth year. Prerequisite, Civil Engineering 115. Mr. Sherman.

117. Water Supply. Three credit hours. Second semester. Three recitations each week. Civil Engineering, fourth year. Prerequisite, Civil Engineering 111, Mechanics 102. Mr. Eno.

118. Cement and Concrete. Three credit hours. Either semester. Ceramic and Civil Engineering, fourth year. Prerequisite, Mechanics 102. Mr. Hindman.

119. Thesis. One credit hour. First semester. Civil Engineering, fourth year. Prerequisite, Civil Engineering 110 and 111.

120. Contracts and Specifications. Two credit hours. Second semester. Two recitations or lectures each week. Civil Engineering, fourth year. Prerequisite, Civil Engineering 106, 109, and 115. Mr. Adams, Mr. Page. (College of Law.) Mr. Eno.

122. Thesis. Four credit hours. Second semester. Civil Engineering, fourth year. Prerequisite, Civil Engineering 119.

124. Trusses. Three credit hours. Either semester. Lectures, recitations, and drawing. Mechanical Engineering, fourth year. Drawing the last three or four weeks. Prerequisite, Mechanics 102 or 104. Architecture, Ceramic and Mine Engineering, third year. Concurrent, Mechanics 102 or 104. Mr. Hindman.

125. Tall Buildings. Three credit hours. Second semester. Three lectures each week. Architectural Engineering, fourth year. Prerequisite, Civil Engineering 124. Mr. Morris.

126. Timber and Masonry. Two credit hours. Second semester. Two lectures or recitations each week. Mechanical Engineering, third year. Prerequisite, Mechanics 101. Mr. Schlesinger.

128. Plane Surveying. Two credit hours. Second semester. One lecture and one field exercise of three hours each week. Architecture, fourth year. Mechanical Engineering, second year. Prerequisite, Engineering Drawing 102, Mathematics 132. Mr. Neilson.

129. Concrete Design. Three credit hours. First semester. Architectural Engineering, fourth year. Prerequisite, Mechanical Engineering 123 and Civil Engineering 124.

130. Cement and Concrete. Two credit hours. Second semester. Architecture and Architectural Engineering, fourth year. Prerequisite, Mechanics 103 and Civil Engineering 129.

For Graduate courses in this department see the Bulletin of the Graduate School.

ELECTRICAL ENGINEERING

Office, 171 Robinson Laboratory

PROFESSORS CALDWELL AND FLOWERS, MR. SHEPARDSON,
MR. BROWN, MR. FARMER

101. Electrical Engineering. Five credit hours. First semester. Three lectures and four laboratory hours each week. Chemical Engineering and Mechanical Engineering, fourth year. Prerequisite, Physics 112 or Physics 114. Mr. Shepardson.

Lectures and laboratory work on direct and alternating current circuits, dynamo machinery, transformers, accumulators, and their applications.

103. Electrical Engineering. Three credit hours. First semester. Two lectures and three laboratory hours each week. Civil and Mine Engineering, fourth year. Prerequisite, Physics 112 or 114. Mr. Flowers, Mr. Shepardson.

Lectures and laboratory work on direct current machinery, circuits, and transmission.

104. Direct Current Machinery. Five credit hours. Second semester. Three lectures and four laboratory hours each week. Electrical Engineering, third year. Prerequisite, Physics 135, Mathematics 142, and Mechanics 101. Mr. Flowers, Mr. Shepardson.

Generators and motors, a study of their theory, construction and operation. Lectures, recitations, problems, and laboratory.

106. Applications of Electricity. One and one-half credit hours. Second semester. Three lectures each week for one-half semester. Electrical Engineering, third year. Prerequisite, Physics 135 and Mathematics 142. Mr. Caldwell.

A brief treatment of the use of electricity, in illumination, railways, mining, etc.

108. Alternating Current Circuits and Machinery. One and one-half credit hours. Three lectures each week for first half of second semester. Electrical Engineering, third year. Prerequisites, Mathematics 142, Physics 135, Mechanics 101; concurrent, Electrical Engineering 104. Mr. Caldwell.

General principles, circuits, generators and transformers.

109. Alternating Current Machinery. Three credit hours. First semester. A continuation of Electrical Engineering 108. Three lectures each week. Electrical Engineering, fourth year. Prerequisite, Electrical Engineering 108; concurrent, Electrical Engineering 111. Mr. Caldwell.

Transformers, synchronous motors, induction motors, etc.

111. Alternating Current Laboratory. Three credit hours. First semester. Electrical Engineering, fourth year. Prerequisite, Electrical Engineering 108; concurrent, Electrical Engineering 109. Mr. Brown.

Alternating current apparatus and accumulators.

112. Advanced Alternating Current Laboratory. Three credit hours. Second semester. Electrical Engineering, fourth year. Prerequisite, Electrical Engineering 109 and 111. Mr. Brown.

113. Electric Railways. Two credit hours. First semester. Electrical Engineering, fourth year. Alternative with Electrical Engineering 115, 117, and 119. Prerequisite, Electrical Engineering 104; concurrent, Electrical Engineering 109. Mr. Caldwell.

Systems, apparatus, and railway operation.

115. Telephony. Two credit hours. First semester. Electrical Engineering, fourth year. Alternative with Electrical Engineering 113, 117, and 119. Prerequisites, Electrical Engineering 104 and 108. Mr. Flowers.

Methods of telephone operation, simple circuits, apparatus and elements of transmission, theory.

117. Electric Illumination. Two credit hours. First semester. Electrical Engineering, fourth year. Alternative with Electrical Engineering 113, 115, and 119. Architectural Engineering, third year. Prerequisite, Physics 112. Mr. Caldwell.

Principles of illumination, electric lamps, etc.

119. Wireless Telegraphy. Two credit hours. First semester. Electrical Engineering, fourth year. Alternative with Electrical Engineering 113, 115, and 117. Prerequisites, Electrical Engineering 104 and 108. Mr. Brown.

Elementary theory, production, transmission, and detection of damped and undamped oscillations.

121. Electrical Design. Three credit hours. First semester. Two three-hour drawing periods each week. Electrical Engineering, fourth year. Prerequisite, Electrical Engineering 104. Mr. Flowers.

Design of direct current dynamos, transformers, etc.

122. Electrical Design. Two credit hours. Second semester. A continuation of Electrical Engineering 121. One four-hour drawing period each week. Electrical Engineering, fourth year. Elective. Mr. Flowers.

Alternating current apparatus.

124. Electrical Transmission and Distribution. Three credit hours. Second semester. Three lectures each week. Electrical Engineering, fourth year. Prerequisite, Electrical Engineering 109. Mr. Caldwell.

Transmission and distribution systems, apparatus, and operation.

125-126. Special Reading and Laboratory. Credit hours to be arranged. The year. Elective for fourth year electrical engineering and graduate students with the consent of the instructor in charge. Prerequisites, Electrical Engineering 104 and 108.

127. Thesis. One credit hour. First semester. Electrical Engineering, fourth year. Prerequisites, Electrical Engineering 104 and 108.

128. Thesis. Five credit hours. Second semester. Electrical Engineering, fourth year.

130. Inspection Trip. March 29 to April 5, 1917. Electrical Engineering, fourth year. Prerequisite, Mechanics 102.

Includes Pittsburg, Buffalo, Niagara, and Cleveland. The entire expense need not exceed $35. A satisfactory written report on the work of the trip and an examination are required.

134. Reading Course. Electrical Engineering, fourth year. This may be taken as a substitute for Electrical Engineering 130 on presentation of reasons satisfactory to the head of the department.

Assigned reading on processes of manufacture and power plants.

131. Inspection Trip. First semester. Electrical Engineering, third year. January 30 to February 2, 1917. Visit to works of electrical and industrial interest at Columbus, Dayton and other nearby points. A written report and examination are required.

138. Advanced Laboratory. Two credit hours. Second semester. One four-hour laboratory period. Electrical Engineering, fourth year. Elective. Mr. Caldwell.

Selected tests on alternating current, apparatus, illumination, railways, etc.

For Graduate courses in this department see the Bulletin of the Graduate School.

ENGINEERING DRAWING

Office, 204 Brown Hall

PROFESSOR FRENCH, ASSISTANT PROFESSORS MEIKLEJOHN,
WILLIAMS, SHEETS, AND TURNBULL, MR. GILBERT,
MR. SVENSEN, MR. INAGAKY

101. Elementary Mechanical Drawing. Two credit hours. Either semester. All four-year courses, first year. Mr. French and department instructors.

Practice in the use of drawing instruments, elementary projections.

102. Mechanical Drawing. Three credit hours. Either semester. All four-year courses, first year. Prerequisite, Drawing 101. Lettering, orthographic, isometric, and oblique projections. Mr. French and department instructors.

103. Descriptive Geometry. Three credit hours. First semester. Two recitations, one drawing period each week. Ceramic, Chemical, Electrical, Mechanical, and Mining Engineering, second year. Prerequisite, Drawing 102 or 114. Mr. French and department instructors.

104. Machine Sketching. Three credit hours. Second semester. One lecture, two drawing periods each week. Ceramic, Chemical, Mechanical and Mine Engineering, second year. Prerequisite, Drawing 103. Mr. Williams, Mr. Sheets, Mr. Gilbert, Mr. Svensen.

105. Descriptive Geometry. Three credit hours. First semester. Two lectures, one drawing period each week. Civil Engineering, second year. Prerequisite, Drawing 102. Mr. Turnbull.

106. Advanced Descriptive Geometry. Three credit hours. Second semester. Two lectures, one drawing period each week. Civil Engineering, second year. Prerequisite, Drawing 105. Mr. Turnbull.

107. Descriptive Geometry. Three credit hours. First semester. Two recitations, one drawing period each week. Architecture, second year. Prerequisite, Drawing 102. Mr. Meiklejohn.

110. Technical Sketching. Two credit hours. Second semester. Electrical Engineering, second year. Prerequisite, Drawing 103. Mr. Williams, Mr. Sheets.

111. Technical Drawing. Two credit hours. First semester. Mechanical and Electrical Engineering, third year. Prerequisite, Drawing 104 or 110. Mr Williams, Mr. Svensen.

113. Free-hand Drawing and Lettering. Four credit hours. First semester. Short courses in Clayworking and Industrial Arts, first year; Short Mining course, second year. Mr. Svensen.

114. Mechanical Drawing. Three credit hours. Second semester. Short courses in Clayworking, Industrial Arts, first year; Short Mining, second year. Prerequisite, Drawing 113. Mr. Svensen.

121-122. Technical Drawing. Two credit hours. The year. Chemical Engineering, third year. Prerequisite, Drawing 104. Mr. Withrow, Mr. Svensen.

Designing of Chemical plants and machinery.

ENGLISH

Office, 103 Physics Building

PROFESSOR DENNEY, ASSISTANT PROFESSORS BECK, ANDREWS, AND PERCIVAL, MR. CRAIG, MR. DISHONG, MR. WILEY, AND DEPARTMENT ASSISTANTS

101. Paragraph Writing: Description and Narration. Two credit hours. Either semester.

English 101 is given also in the Summer Session.

104. Paragraph Writing: Exposition and Argumentation. Two credit hours. Either semester. Prerequisite, English 101.

English 104 is offered also in the Summer Session.

GEOLOGY

Office, 104 Orton Hall

PROFESSORS PROSSER AND BOWNOCKER, ASSISTANT PROFESSOR HILLS, MR. VERWIEBE, MISS MARK, MR. COTTINGHAM

162. Elementary Physiography. Four credit hours. Second semester. Short Mining, first year. Miss Mark.

The physiographic features of the earth's surface and the agencies producing them; the atmosphere; the ocean. Recitations, lectures, map work, and field work.

164. Elementary Geology. Three credit hours. Second semester. Short Mining, second year. Mr. Verwiebe.

Lithological, dynamical, structural, and historical geology. Recitations, lectures, and laboratory work.

165. General Geology. Three credit hours. First semester. Mine Engineering, third year. Ceramic Engineering, fourth year. Mr. Prosser, Mr. Verwiebe.

Structural, dynamical, and historical geology. The lectures are illustrated by maps, specimens, and lantern views. The common rockforming minerals and rocks are studied in the laboratory. The first half of the semester, field trips Friday afternoon or Saturday morning will alternate with laboratory periods.

166. Petrography. Two credit hours. Second semester. Mine Engineering, third year. Mr. Bownocker.

A study of hand specimens of igneous, metamorphic, and sedimentary rocks. Lectures and laboratory work.

167. Economic Geology. Three credit hours. First semester. Mine Engineering, fourth year. Prerequisite, Geology 165-166. Mr. Bownocker.

The nature and origin of ores; their modes of occurrence and distribution. The non-metals, coal, oil, gas, clay, lime, cement, and building stones. In the discussion of the non-metals emphasis will be laid on the products of Ohio.

168. General Geology. Three credit hours. Second semester. Civil Engineering, second year. Mr. Prosser, Mr. Verwiebe.

Structural, dynamical, and historical geology. The lectures are illustrated by maps, specimens, and lantern views. The common rock-forming minerals and rocks are studied in the laboratory. The last half of the semester, field trips Friday afternoon or Saturday morning will alternate with laboratory periods.

For Graduate courses in this department see the Bulletin of the Graduate School.

GERMAN

Offices, 317 and 318 University Hall

PROFESSORS EVANS AND EISENLOHR, ASSISTANT PROFESSORS THOMAS, BARROWS, LEWISOHN AND BUSEY, MR. KEIDEL, MR. KOTZ, MR. REESE, AND DEPARTMENT ASSISTANTS

101-102. Elementary German. Four credit hours. The year. Open to students in any four-year course who enter with a foreign language other than German.

The essentials of grammar and oral practice, first semester.

Reading of easy narrative, grammatical drill, second semester.

German 101 is given also during the second semester.

103. Intermediate German. Four credit hours. First semester. Prerequisite, German 102 or two units entrance credit in German. Not open to students who enter with four units entrance credit in German.

Reading of narrative prose, with topical review of grammar. One hour prose composition each week.

German 103 is given also during the second semester.

106. Science Reading. Four credit hours. Second semester. This course is for engineering students; a continuation of German 103 and 107.

Rapid reading of German technical literature. Drill on sentence structure and word formation. The object of the course is to prepare students to read technical works and current technical literature.

107. Advanced German. Four credit hours. First semester. Open to first-year students who enter with four units credit in German. By agreement with the College of Engineering, students may on securing permission, continue this course in the second semester in place of 106.

INDUSTRIAL ARTS AND SHOPWORK

Office, New Shop Building

PROFESSOR SANBORN, ASSOCIATE PROFESSOR W. A. KNIGHT,
MR. CASE, MR. BEEM, MR. FOUST, MR. DENMAN,
AND DEPARTMENT ASSISTANTS

INDUSTRIAL ARTS

101. Tools and Machines. Three credit hours. Second semester. Three recitations each week. Short Industrial Arts, second year. Prerequisite, Mathematics 114 or 132. Concurrent, Physics 101. Mr. Sanborn.

Principles underlying the construction and operation of machines with a special study of machine tools.

103. Designing. One credit hour. Second semester. Three laboratory hours each week. Short Industrial Arts, second year. Concurrent, Industrial Arts 101. Mr. Sanborn.

112. Machine Design. Two credit hours. Second semester. Four laboratory hours each week. Electrical Engineering, fourth year. Prerequisite, Mechanics 102 and Engineering Drawing 111. Mr. Sanborn.

Practical application of principles of machine design.

114. Shop Building. Two credit hours. Second semester. Two recitations each week. Alternative with Mechanical Engineering 146, fourth year. Prerequisite, Civil Engineering 126. Mr. Sanborn

Lectures and problems on the construction of shop buildings and the arrangement of machinery; special shop appliances.

SHOPWORK

(The classes in shopwork are carried under a different set of numbers from the preceding theoretical classes in Industrial Arts, though they are in the same department.)

105. Foundry Work. Two credit hours. Either semester. One recitation and four laboratory hours each week. Mechanical Engineering, second year. Second semester, Short Industrial Arts, first year. Mr. Beem, Mr. Breckur.

Exercises and practice on tempering sand and preparing molds of machine parts in sand, core-making, melting iron and brass, and pouring.

107. Chipping and Filing. Two credit hours. Either semester. One recitation and four laboratory hours each week. Mechanical Engineering, second year. Ceramic Engineering and Short Clayworking, alternative with 109 and 115, Summer Session. Second semester, Short Industrial Arts, first year. Mr. Case.

Exercises and practice in vise work including chipping in cast and wrought iron, surface filing, squaring, fitting, finishing, the scraping of surface plates, soldering and brazing.

109. Joinery and Pattern-Making. Two credit hours. Either semester. One recitation and four laboratory hours each week. First semester. Short Industrial Arts, first year. Ceramic Engineering and Short Clayworking, alternative with Shopwork 107 and 115. Chemical Engineering, Electrical Engineering, Mechanical Engineering, and Mine Engineering, during the Summer Session at the close of the first year. Mr. Beem, Mr. Denman, Mr. Smith.

Exercises and practice in joinery, wood-turning, and pattern-making, including sawing, planing, mortising, framing, and other work involving the use of the ordinary carpenter tools, center and chuck-turning, and making of finished patterns.

111. Advanced Pattern-Making. One credit hour. Either semester. Three laboratory hours each week. Mechanical Engineering, second year. Second semester, Short Industrial Arts, first year. Prerequisite, Shopwork 109. Mr. Beem, Mr. Denman, Mr. Smith.

113. Cabinet-Making. Two credit hours. Either semester. Six laboratory hours each week. Elective. Prerequisite, Shopwork 109. Mr. Beem, Mr. Denman, Mr. Smith.

Exercises and practice in cabinet-making, including paneling, mitre and dove-tail joints; use of power tools.

115. Forging. Two credit hours. Either semester. One recitation and four laboratory hours each week. Short Industrial Arts, second year. Short Mining, first year. Ceramic, Chemical, Electrical, Mechanical, and Mine Engineering and Short Clayworking, during the Summer Session at the close of the first year. Mr. Foust, Mr. Wright.

The use and care of forge, fire, and tools. Practice in iron and steel forging, including such operations as cutting, bending, drawing, upsetting, shaping, and welding iron; the making, hardening, and tempering of steel punches, chisels, and lathe tools.

118. Advanced Forging. Two credit hours. Second semester. Six laboratory hours each week. Elective. Prerequisite, Shopwork 115. Mr. Foust, Mr. Wright.

Various forms of welds in iron and steel; the use of scrolling irons and of forms for duplicating work; annealing; tool-making, case-hardening; tempering drills, dies, and cutters; spring-making; ornamental iron work; visits to shops.

119. Machine Work. Three credit hours. Either semester. One recitation and six laboratory hours each week. Electrical and Mechanical Engineering and Short Industrial Arts, second year. Mr. Knight, Mr. Case.

Elementary exercises on engine lathe, such as plain, straight and taper turning, screw cutting, chuckling; boring, filing, and polishing, and the use of the drill press.

121. Advanced Machine Work. Three credit hours. Either semester. One recitation and six laboratory hours each week. Mechanical Engineering, third year; Electrical Engineering and Short Industrial Arts, second year. Prerequisite, Shopwork 119. Mr. Knight, Mr. Case.

A continuation of Shopwork 119 with more difficult exercises on the lathe, including square thread cutting, drilling, and tapping, use of steady rest, face-plate work, and bar turning. Also practice on the milling machines, planer, shaper and turret lathe.

123. Advanced Machine Work. Two credit hours. First semester. Six laboratory hours each week. Elective. Prerequisite, Shopwork 121. Mr. Knight, Mr. Case.

A more advanced course in milling machine work and grinding. Exercises in spur and spiral gear cutting, cam cutting, and differential and fractional indexing.

125. Construction Work. Two credit hours. Either semester. Six laboratory hours each week. Elective. Prerequisite, Shopwork 121. Mr. Knight, Mr. Case.

A course in construction work on any piece of apparatus or machinery which may be in course of construction in the shops.

127. Tool-Making and Jig Work. Three credit hours. Either semester. Elective. Prerequisite, Shopwork 123. Mr. Knight, Mr. Case.

130. Advanced Pattern-Making. Three credit hours. Second semester. Short Industrial Arts.

For Graduate courses in this department see the Bulletin of the Graduate School.

MATHEMATICS

Office, 314 University Hall

PROFESSORS BOHANNAN, MCCOARD, SWARTZEL, KUHN, RASOR,
AND MORRIS, ASSOCIATE PROFESSOR ARNOLD, ASSISTANT
PROFESSORS PRESTON, BAREIS, AND WEST,
MISS RICKARD

101-102. Elementary Algebra. Five credit hours. The year. Short Clayworking, Short Industrial Arts, and Short Mining, first year.

113. Plane and Solid Geometry. Five credit hours. First semester. Short Clayworking, Short Industrial Arts, and Short Mining, first year.

114. Solid Geometry and Plane Trigonometry. Five credit. hours. Second semester. Short Clayworking, Short Industrial Arts, and Short Mining, first year. Prerequisite, Mathematics 113.

131. College Algebra and Trigonometry. Five credit hours. Either semester. All four-year courses in Engineering, first year Prerequisites, Entrance Algebra and Geometry.

132. Plane Trigonometry and Analytical Geometry. Five credit hours. Either semester. All four-year courses in Engineering, first year. Prerequisite, Mathematics 131.

This course is given also in the Summer Session.

141. Calculus. Five credit hours. Either semester. All four-year courses in Engineering, second year. Prerequisite, Mathematics 132.

142. Calculus. Five credit hours. Either semester. Continuation of Mathematics 141. All four-year courses in Engineering, second year. Prerequisite, Mathematics 141.

This course is given also in the Summer Session.

127-128. Calculus. Three credit hours. The year. Architecture, second year. Prerequisite, Mathematics 132.

151. Differential Equations. One credit hour. First semester. Mechanical Engineering, third year. Prerequisite, Mathematics 142.

For Advanced Undergraduates and Graduates

Prerequisite: Differential and Integral Calculus.

163-164. Plane and Solid Analytical Geometry. Three credit hours. The year. Mr. Morris.

167-168. Differential Equations. Three credit hours. The year. Mr. Bohannan.

173-174. Modern Higher Algebra. Three credit hours. The year. Mr. Kuhn.

For Graduate courses in this department see the Bulletin of the Graduate School.

MECHANICAL ENGINEERING

Office, 244 Robinson Laboratory

PROFESSORS MAGRUDER, MARQUIS, AND SANBORN, ASSOCIATE PROFESSOR JUDD, MR. BROWN, AND DEPARTMENT ASSISTANTS

101. Mechanism. Three credit hours. First semester. Three recitations each week. Electrical Engineering, third year. Prerequisites, Engineering Drawing 103, Physics 114. Mr. Sanborn.

Recitations on the principles of mechanism and mechanical movements.

103. Steam Power Plants. Three credit hours. First semester. Three recitations each week. Chemical and Mechanical Engineering, third year. Prerequisites, Engineering Drawing 104, Physics 112. Mr. Marquis, Mr. Brown.

A descriptive study of steam-generating and steam-using machinery.

105-106. Heat Power Engineering. Three credit hours. The year. Three recitations each week. Electrical Engineering, third year. Prerequisites, Engineering Drawing 104 and Physics 112; and concurrent, Mechanics 101 and 102. Mr. Marquis, Mr. Brown.

A description and analytical study of steam-generating and steam-using machinery, gas and oil engines.

110. Mechanism and Machine Design. Three credit hours. Second semester. Three recitations each week. Ceramic Engineering, third year. Prerequisites, Engineering Drawing 104, Mechanics 101. Mr. Judd.

Recitations on the principles of mechanism, mechanical movements, and elementary machine design.

114. Mechanism. Three credit hours. Second semester. Three recitations each week. Mechanical Engineering, third year. Prerequisites, Engineering Drawing 104, Physics 112. Mr. Sanborn.

Recitations and practice on the principles of mechanism and mechanical movements.

116. Mechanism Drawing. One credit hour. Second semester. One three-hour drawing period each week. Mechanical Engineering, third year. Prerequisite or concurrent, Mechanical Engineering 114. Mr. Sanborn.

Practice in laying out mechanisms and mechanical movements.

118. Steam Engines. Three credit hours. Second semester. Three recitations each week. Mechanical Engineering, third year. Prerequisite, Mechanical Engineering 103. Concurrent, Mechanics 102. Mr. Magruder.

120. Steam Boilers. One credit hour. Second semester. One recitation each week. Mechanical Engineering, third year. Prerequisites, Mechanical Engineering 103, Mechanics 101. Mr. Marquis.

121. Heating and Ventilating. Three credit hours. First semester. Three recitations each week. Architecture and Architectural Engineering, fourth year. Prerequisite, Mechanics 103, Physics 112 or 118. Mr. Marquis.

Recitations and lectures on the principles and methods of heating and ventilation.

123. Materials of Construction. Two credit hours. First semester. One recitation and three laboratory hours each week. Architectural Engineering, third year. Concurrent, Mechanics 103. Mr. Judd.

Lectures and recitations on the materials used in architectural and building construction, and laboratory exercises on their properties.

125. Gas Engines and Producers. Two credit hours. First semester. Two recitations each week. Mechanical Engineering, fourth year. Prerequisite, Mechanical Engineering 118. Mr. Magruder.

A study of gas engines and of gas producers as used for power purposes.

127. Machine Design. Five credit hours. First semester. Five recitations each week. Chemical and Mechanical Engineering, fourth year. Prerequisites, Engineering Drawing 104 and 111, Mechanics 102, Metallurgy 109, Mechanical Engineering 103. Mr. Magruder, Mr. Sanborn.

A detailed course of study based upon mechanics and the materials of construction applied to the design and construction of machinery.

129. Thermodynamics. Two credit hours. First semester. Two recitations each week. Mechanical Engineering, fourth year. Prerequisite, Mechanical Engineering 118. Mr. Magruder.

The transmutations of heat and mechanical energies in steam and air engines, in air and ammonia compressors, and in refrigeration machines, together with a study of the tests of ideal and actual engines and of their indicator diagrams; the flow of gases through pipes and orifices.

130. Inspection Trip. March 29 to April 5, 1917. Required in Mechanical Engineering, fourth year. Prerequisite, Mechanics 102.

Includes Pittsburgh, Buffalo, Niagara Falls, Cleveland, and possibly other places. The entire expense need not exceed $35. A satisfactory written report upon the work of the trip and examination are required.

134. Reading Course. Mechanical Engineering, fourth year. Written report on assigned reading upon processes of manufacture and power plants. This may be taken as a substitute for Mechanical

Engineering 130 on presentation of reasons satisfactory to the head of the department.

140. Mechanism and Machine Design. Two credit hours. Second semester. Two recitations each week. Civil Engineering, fourth year. Prerequisite, Mechanics 102. Mr. Judd.

An elementary course in the principles of mechanism and mechanical movements and the design of parts of machines.

142. Hydraulic Machinery. Two credit hours. Second semester. Two recitations each week. Mechanical Engineering, fourth year. Prerequisites, Mechanics 102, Mechanical Engineering 118. Mr. Judd.

A study of pumping machinery.

144. Machine Design. Five credit hours. Second semester. Three recitations and two three-hour drawing periods each week. Chemical and Mechanical Engineering, fourth year. Prerequisite, Mechanical Engineering 127. Mr. Magruder and Mr. Sanborn.

A continuation of Mechanical Engineering 127, with practical applications on the drawing board of the principles to the design of some particular machine.

146. Steam Turbines. Two credit hours. Second semester. Two recitations each week. Optional in Mechanical Engineering with Industrial Arts 114, fourth year. Prerequisite, Mechanical Engineering 129. Mr. Marquis.

A study of the generation of power by steam turbines, including auxiliary machinery.

148. Thesis Work. Three credit hours. Second semester. Mechanical Engineering, fourth year. Prerequisites, Mechanical Engineering 125, 127, 129, and 179. Mr. Magruder, Mr. Marquis, Mr. Judd.

A special investigation or design based upon the work of the courses.

150. Hydraulic Power. Three credit hours. Second semester. Two recitations and three laboratory hours each week. Elective in Civil and Electrical, and optional in Mechanical Engineering, fourth year. Prerequisites, Mechanical Engineering 173, 175, or 179. Mr. Judd.

A study of hydraulic turbines and the generation of hydraulic power.

160. Experimental Engineering Laboratory. Two credit hours. Second semester. Four laboratory hours each week. Electrical Engineering, third year. Concurrent, Mechanics 102 and Mechanical Engineering 106. Mr. Marquis, Mr. Judd, Mr. Brown.

Calibration of pressure gauges and indicator springs; steam engine indicator practice; testing of lubricating oils and the materials of construction.

164. Experimental Engineering Laboratory. Two credit hours. Second semester. Four laboratory hours each week. Mechanical Engineering, third year. Concurrent, Mechanics 102 and Mechanical Engineering 118. Mr. Marquis, Mr. Judd, Mr. Brown.

Calibration of pressure gauges and indicator springs; steam engine indicator practice; testing of oils and the materials of construction.

169. Experimental Engineering Laboratory. Two credit hours. First semester. Four laboratory hours each week. Architectural Engineering, fourth year. Concurrent, Mechanical Engineering 121. Mr. Marquis.

Investigations of the heating and ventilating plants of different buildings, lay-outs, and laboratory tests of equipments used in such plants.

171. Experimental Engineering Laboratory. Three credit hours. First semester. One recitation and four laboratory hours each week. Elective in Ceramic and Chemical Engineering, fourth year. Prerequisites, Mechanics 101 and 102 or 104. Mr. Judd, Mr. Brown.

Selected laboratory exercises in the testing of lubricants and the materials of construction; calibration of pressure gauges and indicator springs; steam engine indicator practice; and brake tests of steam engines.

173. Experimental Engineering Laboratory. Five credit hours. First semester. Two recitations and six laboratory hours each week. Civil Engineering, fourth year. Prerequisite, Mechanics 102. Mr. Marquis, Mr. Judd, Mr. Brown.

Practice in the testing of the materials of construction; calibration of orifices and weirs; study of the flow of liquids and gases; tests of steam, power, rotary, and centrifugal pumps, tests of water motors and turbine water wheels. Lectures and recitations on same and on steam engines, boilers, and transmission machinery.

175. Experimental Engineering Laboratory. Three credit hours. First semester. Six laboratory hours each week. Electrical Engineering, fourth year. Prerequisites, Mechanical Engineering 106 and 160. Mr. Marquis, Mr. Judd, Mr. Brown.

Tests of steam engines and boilers, of gas and oil engines, and of steam and power pumps; hydraulic experimentation; and the use of transmission and absorption dynamometers.

179. Experimental Engineering Laboratory. Two credit hours. First semester. Four laboratory hours each week. Mechanical Engineering, fourth year. Prerequisite, Mechanical Engineering 164. Concurrent, Mechanical Engineering 125 and 129. Mr. Marquis, Mr. Judd, Mr. Brown.

Valve setting, moisture determinations in steam, gas calorimetry, measurements of flow of water by means of orifices, nozzles, weirs, and venturi-meter; tests of belts with use of transmission and absorption dynamometers.

190. Experimental Engineering Laboratory. Six credit hours. Second semester. Twelve laboratory hours each week. Mechanical Engineering, fourth year. Prerequisites, Mechanical Engineering 125, 129, and 179. Mr. Marquis, Mr. Judd, Mr. Brown.

Tests of steam and hot-air engines; steam boilers; gas and oil engines; gas producers; air compressors; injectors and pulsometers; centrifugal, rotary, and power pumps; hydraulic rams, impulse and turbine water wheels; fans and blowers, and steam turbines.

192. Experimental Engineering Laboratory. Three credit hours. Second semester. One recitation and four laboratory hours each week. Mine Engineering, fourth year. Prerequisites, Mechanics 102, Metallurgy 109. Mr. Judd, Mr. Brown.

Lectures and recitations on power transmission, steam and gas engines, steam boilers, and gas producers. Laboratory work in the calibration of pressure gauges and indicator springs; valve setting; testing of steam engines, testing of steam and centrifugal pumps; boiler and fuel trials; tests of gas engines and gas producers.

For Graduate courses in this department see the Bulletin of the Graduate School.

MECHANICS

Office, 219 Lord Hall

PROFESSORS BOYD AND CODDINGTON

The laboratory work in strength of materials, involving the use of testing machines, is given at present in the Department of Mechanical Engineering.

101. Statics and Strength of Materials. Five credit hours. First semester. Ceramic, Chemical, Civil, Electrical, Mechanical, and Mine Engineering, third year. Prerequisite, Mathematics 142.

102. Strength of Materials: Kinetics and Hydraulics. Five credit hours. Second semester. Chemical, Civil, Electrical, Mechanical, and Mine Engineering, third year. Prerequisite, Mechanics 101.

103. Statics and Strength of Materials. Five credit hours. First semester. Architecture and Architectural Engineering, third year. Prerequisite, Mathematics 128 or 142.

104. Strength of Materials. Two credit hours. Second semester. Architecture and Ceramic Engineering, third year. Prerequisite, Mechanics 101.

For Graduate courses in this department see the Bulletin of the Graduate School.

METALLURGY

Office, 100 Lord Hall

PROFESSORS SOMERMEIER AND DEMOREST, ASSISTANT PROFESSOR McCAUGHEY, MR. E. C. SMITH

102. Mineral Chemistry. Four credit hours. Second semester. Short Mining, second year. Prerequisite, Chemistry 101. Mr. Demorest, Mr. Minor.

A course of lectures upon mine gases, safety lamps, mine explosions, boiler water, mine water, water supply, explosives, coal, and coke.

105. Fire Assaying. Three credit hours. First semester. Mine Engineering, third year. Laboratory, two afternoons each week, Monday and Tuesday, or Thursday and Friday. Prerequisite, Metallurgy 106, or equivalent. Mr. McCaughey.

Lectures and laboratory work. Practical work in the assaying of gold, silver, and lead ores.

106. Metallurgical Analysis. Four credit hours. Second semester. One lecture, nine laboratory hours each week. Mine Engineering, second year. Prerequisite, Chemistry 106 or 110, Chemistry 119. Mr. Demorest.

Lectures and laboratory work. Laboratory work in the analysis of iron ores, iron and steel, fuel and slags, and ores of lead, zinc, and copper by wet methods, using approved methods as practiced in technical laboratories and metallurgical works.

107. Alloy Analysis. Four credit hours. First semester. One lecture, nine laboratory hours each week. Mine Engineering, third year. Prerequisite, Metallurgy 106. Mr. Demorest.

Lectures and laboratory work. Laboratory work in the analysis of alloy steels, such as vanadium, tungsten, chromium, nickel and molybdenum steels and other alloys. Quantitative work preceded by qualitative tests on the alloys.

117. Fuel. Two credit hours. First semester. Four recitations each week during first half of first semester. Chemical, Mechanical and Mine Engineering, third year; Ceramic Engineering, fourth year. Prerequisite, Chemistry 106 or 110 and Physics 112 or 114. Mr. Somermeier.

Lectures, recitations and problems on fuels, their properties, uses, and manufacture.

119. Iron and Steel. Two credit hours. First semester. A continuation of Metallurgy 117. Four recitations each week during second half of first semester. Chemical, Mechanical and Mine Engineering, third year; Ceramic Engineering, fourth year. Mr. Demorest.

Lectures, recitations and problems on metallurgy of iron and steel.

110. Metallurgy of Non-Ferrous Metals. Four credit hours. Second semester. Mine Engineering, third year. Mr. Demorest.

Lectures and recitations on the metallurgy and properties of the non-ferrous metals; copper, lead, gold, silver, aluminum, zinc.

111. Principles of Metallurgical Construction. One credit hour. Two recitations during first half of first semester. Mine Engineering, fourth year. Prerequisites, Drawing 111, Mechanics 102, Metallurgy 109 and 113. Mr. Somermeier.

Lectures and recitations on the principles involved in the designing of furnaces and metallurgical plants.

112. Technical Gas Analysis. Two credit hours. Second semester. Mine Engineering, third year. Two afternoons each week. Prerequisite, Metallurgy 106, 109, or equivalent. Mr. Demorest.

Laboratory work supplemented by lectures. Technical analysis of metallurgical and mine gases. Determination of the calorific value of gases; problems involving application of results of gas analysis to furnace operation, mine ventilation, etc.

113. Ore Dressing and Coal Washing. Two credit hours. First semester. Mine Engineering, fourth year. Prerequisite, Metallurgy 109. Mr. McCaughey.

Methods of concentrating and enriching ores and fuels by mechanical means. Lectures with references to standard books and various papers in technical journals.

114. Special Metallurgy. Three credit hours. Second semester. Mine Engineering, fourth year. Hours to be arranged. Prerequisites, Metallurgy 106, 107, 109, 110, or equivalent. Mr. E. C. Smith.

Laboratory practice supplemented by lectures on microscopic examination of metals, study of properties of alloys, testing of metallurgical processes, pyrometry, and high temperature measurements, calorimetry, and other tests on fuels.

116. Thesis. Three credit hours. Second semester.

For Graduate courses in this department see the Bulletin of the Graduate School.

MILITARY SCIENCE AND TACTICS

Office, The Armory

CAPTAIN GEORGE L. CONVERSE, U. S. A., RETIRED, AND
LIEUTENANT THORPE, U. S. A., RETIRED

In accordance with the Morrill Act, passed in 1862, under which the University was established, military instruction must be included in the curriculum. The Board of Trustees therefore requires all male students, both special and regular, *unless excused by the Military and Gymnasium Board*, to drill during two years. This work is under two officers of the regular army, detailed for the purpose. The Military Department offers instruction during four days each week throughout the year.

1. Military Drill. One credit hour. Five months, three hours each week, (divided between fall and spring) military drill; four months, three hours each week, (winter) of class-room instruction in drill regulations. Target practice at any open hour during the afternoon of the winter months, at 100, 200, and 300 yards. Lecture, one hour each week, by the President, upon topics of common interest to the student body.

2. Military Drill. One credit hour. Five months, three hours each week, (divided between fall and spring) in extended order and guard duty; four months, three hours each week (winter) of class-room instruction in Articles of War, guard manual, and field service regulations; target practice, at any open hour of the afternoon of the winter months, at 500, 600, and 800 yards.

MINE ENGINEERING

Office, 200 Lord Hall

PROFESSOR RAY, ASSISTANT PROFESSOR MINOR

101. Mine Engineering. Five credit hours. First semester. Lectures and field practice. Short Course in Mining, second year. Prerequisite, Mathematics 114. Mr. Minor.

This course is similar to Mine Engineering 103, but more elementary. The same text is used. The students have more practice in the drawing room.

102. Mine Engineering. Five credit hours. Second semester. Short Course in Mining, second year. Prerequisites, Mine Engineering 101, Physics 101. Mr. Minor.

Lectures illustrated by experiments, and maps of mines and models when possible; tests by safety lamps and anemometers; methods of air distribution in coal mines.

103. Mine Surveying. Four credit hours. First semester. Mine Engineering, second year; Ceramic Engineering, third year. Prerequisites, Engineering Drawing 104, Mathematics 132. Mr. Ray, Mr. Minor.

Field practice in the use of instruments for surface and underground surveys. Field notes are taken and maps and plans made in the drawing room.

104. Plans and Specifications. Four credit hours. Second semester. Mine Engineering, fourth year. Prerequisites, Mine Engineering 105, Metallurgy 111. Mr. Ray, Mr. Minor.

Practice in designing mine plants, drafting, and estimating.

105-106. Mine Engineering. Five credit hours. The year. Mine Engineering, fourth year. Prerequisites, Mechanics 102, Mine Engineering 103, Geology 165. Mr. Ray.

Lectures on mine operating, mining machinery, ventilation, shaft sinking, working out deposits, etc. Constant reference is required to standard works and to the leading technical journals.

107. Mine Engineering. Two credit hours. First semester. Four laboratory hours each week. Short Mining, second year. Mine Engineering 101, concurrent. Mr. Minor.

109-110. Mine Trip. One credit hour. The year. Mr. Minor.

111. Metallurgical Design. One credit hour. First semester. Mine Engineeering, fourth year. Six laboratory hours each week during the second half of the first semester. Prerequisites, Drawing 111, Mechanics 102, Metallurgy 111, 113, 117, and 119. Mr. Minor.

Drawing room practice on the designing of furnaces and metallurgical plants.

116. Thesis. Three credit hours. Second semester. Mr. Ray, Mr. Minor.

For Graduate courses in this department see the Bulletin of the Graduate School.

MINERALOGY

Office, 104 Lord Hall

ASSISTANT PROFESSOR MCCAUGHEY

102. Crystallography and Mineralogy. Three credit hours. Either semester. Mine Engineering, second year; Chemical Engineering, third year; Pharmacy, fourth year. Prerequisite, Chemistry 106 or 110.

Lectures on crystallography, physical and descriptive mineralogy. Illustrated by drawings, models, and mineral specimens.

104. Determinative Mineralogy. Three credit hours. Second semester. One lecture, six laboratory hours each week. Mine Engineering, third year. Prerequisite, Mineralogy 102.

Lectures and laboratory work in practical determination of minerals by physical and chemical tests. Each student is furnished with a set of apparatus and works under an instructor's inspection. Brush and Penfield's " Determinative Mineralogy" is used as a manual.

121. Microscopic Mineralogy. Three credit hours. First semester. One lecture and six laboratory hours each week. Prerequisites, Mineralogy 102 and Physics 114.

The use of the polarizing microscope in the identification of minerals in fine powder and in thin section. Determination of the optical constants of minerals and crystallized bodies with the polarizing microscope.

124. Microscopic Petrography. Three credit hours. Second semester. Prerequisites, Geology 165, 166, Mineralogy 102, 121.

The study of igneous and metamorphic rocks, especially their mineralogical and chemical composition, also their textural and genetic relations. Laboratory work with petrographic microscope and thin section of rocks.

126. Advanced Crystallography and Physical Mineralogy. Three credit hours. Second semester. Two lectures and three laboratory hours each week. Prerequisites, Physics 114, Mineralogy 102.

The study of the geometrical and physical properties of crystals. Laboratory work on the measurement, calculation, and projection of crystals and the determination of the physical and optical constants of crystallized bodies.

PHYSICAL EDUCATION

Office, The Gymnasium

PROFESSORS ST. JOHN, WILCE, AND CASTLEMAN, MR. OHLSON, MR. MARSH, MR. TRAUTMAN

101-102. Physical Education. One credit hour. The year. Two hours each week. Required of all first-year students. In the case of women, two years are required. During the first semester the course consists of one lecture on personal hygiene and one period of active physical exercise each week.

(a). Personal Hygiene. Lectures and quizzes on the cause, prevention, and hygienic treatment of the common preventable diseases and conditions which lower the vitality and interfere with the health and efficiency of the students.

(b). Physical exercise in class. A graded course of free-hand exercises, with light hand apparatus for the relief and correction of slight bodily defects, improper carriage, etc. Progressive exercises on the apparatus and mats, to promote muscular tone, organic vigor, bodily skill, etc. Dancing, gymnastic and athletic games and contests.

MEDICAL EMERGENCY SECTION

Office, 103 Biological Building

DR. H. SHINDLE WINGERT

This department maintains a medical emergency section, open to all students, male or female, in the department. Emergency medical advice and treatment is furnished free to students while on the campus, during regular University hours.

PHYSICS

Office, 107 Physics Building

PROFESSORS COLE, EARHART, BLAKE, BARNETT, AND SHEARD,
ASSISTANT PROFESSOR ALPHEUS W. SMITH, MR. HEIL,
MR. WOODBURY, MR. A. W. SMITH, AND
DEPARTMENT ASSISTANTS

101. Elementary Physics. Six credit hours. First semester. Five recitations and lectures, and three laboratory hours each week. Short Clayworking, second year; Short Mining, first year. Textbook, Millikan and Gale's Elements of Physics. Mr. Jackson.

111. General Physics. Three credit hours. First semester. Two lectures, one recitation, and two laboratory hours each week. Architectural, Ceramic, Chemical, Civil, and Mine Engineering, second year. Prerequisite, entrance physics and Mathematics 132. All instructors.

112. General Physics. Three credit hours. Second semester. Two lectures, one recitation, and two laboratory hours each week. Architectural, Ceramic, Chemical, Civil, Mechanical and Mine Engineering, second year. Prerequisite, Physics 111. All instructors.

113. General Physics. Five credit hours. First semester. Two lectures, three recitations, and two laboratory hours each week.

Electrical and Mechanical Engineering, second year. Prerequisites, Elementary Physics and Mathematics 132. All instructors.

Mechanics and heat.

114. General Physics. Five credit hours. Second semester. Two lectures, three recitations, and two laboratory hours each week. Electrical Engineering, second year. Prerequisite, Physics 113. All instructors.

Electricity, light, and sound. A continuation of Physics 113.

117. General Physics. Two credit hours. First semester. Two recitations each week in mechanics, acoustics and heat with demonstrations. Architecture, second year. Prerequisite, entrance physics and Mathematics 132.

118. General Physics. Two credit hours. Second semester. Two recitations each week in electricity and light with demonstrations. Architecture, second year. Prerequisite, Physics 117.

133. Physical Laboratory. Two credit hours. First semester. Four laboratory hours each week. Electrical Engineering, second year. Concurrent, Physics 113. Mr. Smith, Mr. Heil.

134. Electrical Measurements and Photometry. Three credit hours. Second semester. Six laboratory hours each week. Electrical Engineering, second year. Concurrent, Physics 114, Mathematics 142. Mr. Barnett, Mr. Strait.

135. Electrical Measurements and Photometry. Five credit hours. First semester. Nine laboratory hours each week. A continuation of Physics 134. Electrical Engineering, third year. Prerequisites, Physics 114 and 134, Mathematics 141-142. Mr. Barnett, Mr. Strait.

136. Physical Laboratory. Four credit hours. Second semester. Six laboratory hours each week, in electrical measurements; two laboratory hours each week, in mechanics and heat experiments. General Engineering, second year. Concurrent, Physics 114 and Mathematics 142. Mr. Barnett, Mr. Strait.

137. Physical Laboratory. Three to five credit hours. First semester. Prerequisite or concurrent, Physics 111. Elective.

138. Physical Laboratory. Two credit hours. Second semester. Four laboratory hours each week. Mechanical Engineering, second year. Prerequisite, Physics 111; concurrent, Physics 112. Elective, three to five credit hours. Mr. Smith. Mr. Heil.

139-140. Advanced Electrical Measurements. Three to five credit hours. The course may be elected either semester. Prerequisite, Physics 135 or equivalent. Mr. Barnett.

This course is subject to considerable variation to meet the needs of individual students, but a large amount of time is always devoted to oscillograph work.

123-124. Advanced Laboratory. Three to five credit hours. The year. Prerequisite, Physics 121-122. Mr. Cole.

***144. Electricity.** Three credit hours. Second semester. Prerequisite, Physics 103-104 or 105-106; calculus precedes or accompanies. Mr. Earhart.

For Graduate courses in this department see the Bulletin of the Graduate School.

ROMANCE LANGUAGES AND LITERATURES

Office, 305 University Hall

PROFESSORS BOWEN, BRUCE, AND INGRAHAM, ASSISTANT PROFESSORS HAMILTON, CHAPIN, AND PEIRCE, MR. DITCHY, MR. MOORE, MR. CARDON, AND DEPARTMENT ASSISTANTS

FRENCH

101-102. Elementary French. Four credit hours. The year. Four recitations each week. May be taken by students in any four-year course who enter with no entrance credits in French. Text-books: Fraser and Squair's Grammar, or equivalent, and Aldrich and Foster's or Bowen's First Scientific Reader. Historical and narrative prose; one or more prose comedies.

French 101 is given also during the second semester.

103. Modern French Literature. Four credit hours. First semester. Four recitations each week. May be taken by first-year students in any four-year course who enter with two units entrance credit in French. Prerequisite, French 101-102, or two entrance credits.

---

*Not given in 1916-1917.

The work of the year deals with the following subjects: (1) Contes; (2) The novel (Balzac or Hugo); (3) Lyric poetry; (4) Romantic drama (Hugo). Prose composition, with practice in speaking. Systematic attention given to syntax and idiom. Lectures supplement the work. Private reading required.

106. Science Reading. Four credit hours. Second semester. Four recitations each week. Must be taken by students in Engineering who take French 103 during the first semester.

A course of rapid reading introductory to the vocabulary of scientific literature.

SPANISH

101-102. Elementary Spanish. Four credit hours. The year. Four recitations each week. May be taken by students in any four-year course who enter with no entrance credit in Spanish. Textbooks: Ingraham-Edgren's Grammar, or equivalent, and Ingrahams' Victoria Otros Cuentos.

Easy prose and plays. Composition and practice in speaking. Spanish 101 is given also during the second semester.

103-104. Modern Spanish Literature. Four credit hours. The year. Four recitations each week. May be taken by students who enter with two units entrance credit in Spanish. Prerequisite, Spanish 101-102, or two units entrance credit.

The modern novel and drama. Lectures covering a survey of the literature. Composition and practice in speaking continued.

SHOPWORK

(See Industrial Arts)

SPANISH

(See Romance Languages)

FEES AND EXPENSES

All fees must be paid at the opening of each semester as a condition of admission to classes. Registration is not complete until the incidental and laboratory fees are paid.

Incidental Fee. The fee is fifteen dollars each semester.

Former students, who do not pay this fee until the third day of the first semester and the second day of the second semester, must pay one dollar additional. For each day of delay thereafter, fifty cents is added.

Laboratory Deposit. Students are required to pay for all materials consumed in laboratory work. To meet the cost of these materials, a deposit for each course requiring such supplies, is made at the Bursar's office before the work is begun. In Chemistry the deposit is ten dollars. In other courses it varies with the amount of materials used. All laboratory supplies are sold at the General Store Room, Chemistry Hall, to students at about first cost to the University, and charged against the deposits. Any unused part of the deposits is refunded at the end of the semester.

Students should present their class-cards to the Bursar when they pay laboratory deposits.

OTHER EXPENSES

Locker Fee. The gymnasium is free to all students, but those desiring to use a locker are charged a fee of two dollars a semester, which includes the rental of towels.

Cadet Uniform. The uniform with which the members of the regiment are required to provide themselves costs (without overcoat) about twelve dollars. It is quiet in pattern and may be worn in place of civilian dress.

New students are advised against buying second-hand uniforms unless they have been previously inspected and approved by the Commandant. Inspection has shown in many cases that second-hand uniforms were unfit to wear and certainly not worth the price asked for them. All such uniforms are subject to rejection by the Commandant. Students should not arrange for uniforms until so directed by the military authorities.

Changes in Subjects or Schedule. Changes in subjects or schedule if made at the request of the student, shall be made only upon the payment of a fee of $1.00 for each change. The fee, in exceptional cases, may be remitted by the Executive Committee of the College.

Graduation Fee. A fee of five dollars, to cover expense of graduation and diploma, is required of each person receiving one of the ordinary degrees from the University, and this fee must be paid before the last Friday preceding Commencement. A like fee of ten dollars is charged each person receiving one of the higher graduate degrees.

The Ohio Union. A fee of one dollar a semester is paid by all male students at registration. This entitles the student to all privileges of the Union, consistent with the constitution and house rules governing it.

Text-Books. Students should not purchase text-books until they are advised by the instructors of their respective classes.

EXPENSES PER YEAR

One of the most perplexing questions that confronts a prospective student is what the course is going to cost him a year.

In order to furnish information, we have listed below an estimate of the average payments required by the University for the freshman year in the College of Engineering, and have estimated the cost for room and boarding at a safe price. These two items are sometimes reduced slightly where two students occupy the same room and where boarding clubs are economically managed. Fees to the University are paid one-half at the beginning of each semester:

Incidental fee	$ 30 00
Ohio Union	2 00
Gymnasium locker	4 00
Deposits to cover laboratory materials and breakage.	20 00
Drawing instruments and supplies	20 00
Uniform, gloves and shirt	15 00
Books	15 00
Board—36 weeks at $3.50 per week	126 00
Room rent, at $8.00 per month	72 00
General expenses	100 00
	$404 00

The item of general expenses is always subject to the personal habits of the individual, and varies according to the degree of economy exercised.

Note—In order to meet all the necessary expenses of registration, books, uniform, and other expenditures incident to securing a room and board, a student should come prepared to expend from $65.00 to $75.00 during the first ten days of a semester. After that period his board and room rent will constitute the major part of his expenses.

FELLOWSHIP

The Stillman W. Robinson Fellowship in Engineering, endowed by the late Emeritus Professor of Mechanical Engineering, Stillman W. Robinson, for the encouragement of graduate research in engineering, provides five hundred ($500.00) annually, and is open to graduates in Mechanical, Civil, and Electrical Engineering. Any student to whom this fellowship is awarded must devote his entire time to the work, which shall amount to at least sixteen credit hours per week, of which at least eight shall be in the line of original research. For one year's work and a satisfactory thesis, a master's degree will be conferred. For three years, work, and a satisfactory thesis, a doctor's degree will be conferred. For further information consult or address the Secretary of the College of Engineering.

OFFICE HOURS OF THE SECRETARY OF THE COLLEGE

Consultation. The office hour of the Secretary of the College of Engineering is from 10 to 11 a. m. daily, Room 131, Lord Hall. Students desiring to consult the Secretary in regard to the filing of petitions, changes of courses, or of class cards, adjustment of schedules and similar needs should see him during his office hours.

The Ohio State University Bulletin is published at least twenty times during the year as follows: Monthly in June, July, August, and September, and bi-weekly in October, November, December, January, February, March, April, and May.

PRESS OHIO STATE REFORMATORY

78.771
Oh Z 3-0

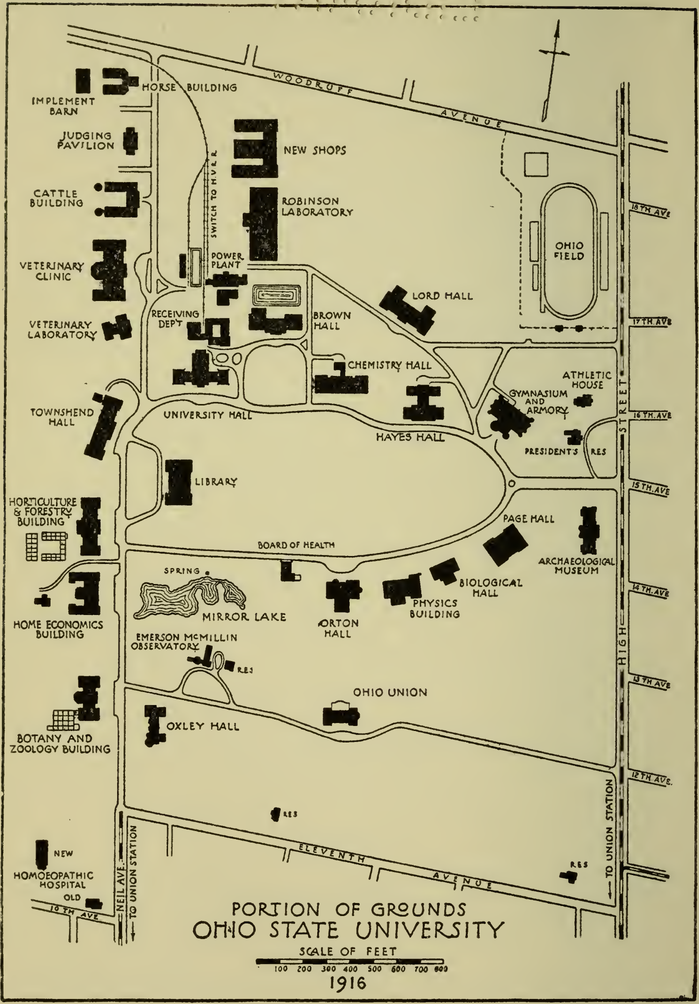
The Ohio State University Bulletin
VOLUME XXI JANUARY, 1917 NUMBER 10

COLLEGE OF ENGINEERING

1917-1918

PUBLISHED BY THE UNIVERSITY AT COLUMBUS

Entered as second-class matter November 17, 1905, at the Post
Office at Columbus, Ohio, under Act of Congress, July 16, 1894



PORTION OF GROUNDS
OHIO STATE UNIVERSITY

1916

UNIVERSITY CALENDAR

1917

Entrance examinations, Tuesday to Saturday, June 19 to 23, 8 A. M.

Summer Session, Thursday, June 21 to Thursday, August 16.

Entrance examinations, Tuesday to Saturday, September 11 to 15, 8 A. M.

Registration Day—First Semester—Tuesday, September 18.

President's Annual Address, Thursday, September 20, 11 A. M.

Latest date for registration of candidates for a degree at the Commencement of June, 1918, October 1.

Registration Day, Short Courses in Agriculture—First Term—Tuesday, October 16.

Mid-semester reports to the Deans concerning delinquent students, Wednesday, November 21.

Thanksgiving recess begins November 28, 1 P. M., and ends December 4, 8 A. M.

Christmas recess begins Friday, December 21, 6 P. M.

1918

Christmas recess ends Tuesday, January 8, 8 A. M.

Registration Day, Short Courses in Agriculture—Second Term—Tuesday, January 8.

Final examinations, Wednesday, January 23 to Thursday, January 31.

First semester ends Thursday, January 31, 6 P. M.

Farmers' Week, Monday, January 28 to Friday, February 1.

Registration Day—Second Semester—Tuesday, February 5.

Washington's Birthday, Friday, February 22.

Close of Second Term, Short Courses in Agriculture, Friday, March 15.

Mid-semester reports to the Deans, Saturday, March 16.

Easter recess, Friday, March 22, 6 P. M., to Tuesday, April 2, 8 A. M.

Memorial Day, Thursday, May 30.

Competitive Drill—Cadet Regiment—Saturday, June 1.

Final examinations, Wednesday, June 5 to Thursday, June 13.

Commencement, Tuesday, June 18.

Entrance examinations, Tuesday, June 25 to Saturday, June 29, 8 A. M.

Summer Session, Monday, June 24 to Friday, August 16.

ADMINISTRATION

BOARD OF TRUSTEES

Guy W. Mallon	Cincinnati
Oscar E. Bradfute	Xenia
Frank E. Pomerene	Coshocton
Benjamin F. McCann	Dayton
John F. Cunningham	Cleveland
John Kaiser	Marietta
Charles F. Kettering	Dayton

ADMINISTRATIVE OFFICERS

President .... William Oxley Thompson
Office: University Hall—99312; N. 476
Residence: University Grounds—2056

Secretary of the Board of Trustees and Business Manager .... Carl E. Steeb
Office: University Hall (East End)—99332; N. 32
Residence: 1956 Iuka Ave.—5835

Registrar, University Editor and Secretary of the University Faculty .... Edith D. Cockins
Office: 101 University Hall—99314
Residence: 1348 Neil Ave.—16310

Secretary of the Entrance Board .... Lester E. Wolfe
Office: 107 University Hall—99353; N. 939
Residence: 1546 Neil Ave.

Executive Clerk .... Katharine H. Duncan
Office: University Hall—99312; N. 476
Residence: The Normandie—5026

Cashier .... Bess C. Watters
Office: University Hall (East End)—99332; N. 32
Residence: 1851 N. Fourth St.—N. 2108

COLLEGE OF ENGINEERING

Acting Dean .... Edwin F. Coddington
Office: 131 Lord Hall—99331
Residence: 426 Fifteenth Ave.—11920

Secretary .... Charles C. Morris
Office: 131 Lord Hall—99331
Residence: 149 E. Frambes Ave.—11079

THE TEACHING STAFF

PROFESSORS

Rosser Daniel Bohannan, B. Sc., C. E., E. M...226 Sixteenth Avenue
Professor of Mathematics

Benjamin Lester Bowen, Ph. D., Litt. D......775 East Broad Street
Professor of Romance Languages and Literatures

Joseph Villiers Denney, M. A...... .....190 West Eleventh Avenue
Professor of English and Dean of the College of Arts, Philosophy and Science

Edward Orton, Jr., E. M ....629 East Broad Street
Research Professor of Ceramic Engineering

William Thomas Magruder, M. E...........342 West Ninth Avenue
Professor of Mechanical Engineering

William McPherson, M. Sc., D. Sc., Ph. D.....198 Sixteenth Avenue
Professor of Chemistry and Dean of the Graduate School

Joseph Nelson Bradford, M. E................1778 North High Street
Professor of Architecture and University Architect

Henry Curwen Lord, B. Sc......................University Campus
Professor of Astronomy and Director of the Emerson McMillen Observatory

Frank Edwin Sanborn, S. B. in M. E ....90 Fourteenth Avenue
Professor of Industrial Arts and Director of the Department

Frank Arnold Ray, E. M............515 Huntington Bank Building
Professor of Mine Engineering

George L. Converse, Major U. S. A............. ..1463 Neil Avenue
Professor of Military Science and Tactics

Francis Cary Caldwell, B. A., M. E............206 Sixteenth Avenue
Professor of Electrical Engineering

John Adams Bownocker, D. Sc ....185 Fifteenth Avenue
Professor of Inorganic Geology and State Geologist of Ohio

Alfred Dodge Cole, M. A......... ....1648 Neil Avenue
Professor of Physics

Christopher Elias Sherman, C. E ....141 Thirteenth Avenue
Professor of Civil Engineering

Frank Harvey Eno, B. Sc., C. E.............222 Sixteenth Avenue
Professor of Municipal Engineering

James Ellsworth Boyd, M. Sc.............188 East Frambes Avenue
Professor of Mechanics

Thomas Ewing French, M. E...............1458 Worthington Street
Professor of Engineering Drawing

George Washington McCoard, M. A...............1474 Neil Avenue
Professor of Mathematics

William Edwards Henderson, Ph. D...........214 Sixteenth Avenue
Professor of Inorganic and Physical Chemistry

Charles A. Bruce, B. A.........................1981 Indianola Avenue
Professor of Romance Languages

Charles William Foulk, B. A......................384 King Avenue
Professor of Analytical Chemistry

Karl Dale Swartzel, M. Sc.........................1952 Iuka Avenue
Professor of Mathematics

Harry Waldo Kuhn, Ph. D.....................Grandview Heights
Professor of Mathematics

Clyde Tucker Morris, C. E.......................2043 Iuka Avenue
Professor of Structural Engineering

Edward Elsworth Somermeier, G. Ph............. 41 King Avenue
Professor of Metallurgy

Samuel Jackson Barnett, Ph. D...........241 West Eleventh Avenue
Professor of Physics

William Lloyd Evans, M. Sc., Ph. D.....81 South Champion Avenue
Professor of Chemistry

Marshall Blakemore Evans, Ph. D...........38 East Twelfth Avenue
Professor of German

Alan Estis Flowers, M. E. in E. E., M. M. E., Ph. D ....
.... 1634 Neil Avenue
Professor of Electrical Engineering

Edwin F. Coddington, C. E., M. Sc., Ph. D...426 Fifteenth Avenue
Professor of Mechanics

Robert F. Earhart, Ph. D..................371 West Tenth Avenue
Professor of Physics

James Renwick Withrow, B. Sc. (Chem.), Ph. D..................
..................................77 East Sixteenth Avenue
Professor of Chemistry

Berthold August Eisenlohr, M. A.... ......356 Twentieth Avenue
Professor of German

Frederic Columbus Blake, Ph. D..............................
Professor of Physics

Edgar Schugert Ingraham, Ph. D ......182 East North Broadway
Professor of Romance Languages

Samuel Eugene Rasor, M. A., M. Sc.............1594 Neil Avenue
Professor of Mathematics

Charles St. John Chubb, Jr., C. E. (Arch.)..237 Seventeenth Avenue
Professor of Architecture

Dana James Demorest, B. Sc. in Chem. Engr..372 Fourteenth Avenue
Professor of Metallurgy

Franklin Wales Marquis, B. Sc. in M. E., M. E....................
....412 West Eighth Avenue
Professor of Steam Engineering

Lynn Wilbur St. John, B. Ph...................168 Twelfth Avenue
Professor of Physical Education

John Woodworth Wilce, B. A ....70 Twelfth Avenue
Professor of Physical Education

Frank Riley Castleman, B. Sc..... ....113 East Norwich Avenue
Professor of Physical Education

Arthur S. Watts ....1835 Indianola Avenue
Professor of Ceramic Engineering

Charles C. Morris, M. A ....149 East Frambes Avenue
Professor of Mathematics

Charles F. Kelley, B. A ....1951 Summit Street
Professor of Art

William John McCaughey, B. Sc. (Chem.), Ph. D...............
.... 108 East Frambes Avenue
Professor of Mineralogy

James D. Tilford, Captain U. S. A ....57 Lexington Avenue
Professor of Military Science and Tactics

Robert G. Sherrard, 1st Lieutenant U. S. A....415 Fifteenth Avenue
Professor of Military Science and Tactics

ASSOCIATE PROFESSORS

Charles Lincoln Arnold, M. Sc.................328 West Eighth Avenue
Associate Professor of Mathematics

William Abner Knight, M. E.................206 West Lane Avenue
Associate Professor of Machine Shop Practice

Horace Judd, M. E., M. Sc..... ....281 Thirteenth Avenue
Associate Professor of Experimental Engineering

Edmund Sewall Manson, Jr., M. Sc.......... .....2 Indianola Court
Associate Professor of Astronomy

ASSISTANT PROFESSORS

Alpheus Wilson Smith, M. A., Ph. D ....306 Sixteenth Avenue
Assistant Professor of Physics

John Bowker Preston, M. A...................290 Fifteenth Avenue
Assistant Professor of Mathematics

Robert Meiklejohn, M. E................. 419 West Ninth Avenue
Assistant Professor of Engineering Drawing

May Thomas, Ph. D......... ....233 West Eleventh Avenue
Assistant Professor of German

Grace Bareis, Ph. D.....................201 West Eleventh Avenue
Assistant Professor of Mathematics

Theodore Ely Hamilton, M. A., Ph. D ....319 King Avenue
Assistant Professor of Romance Languages

Sarah Tracy Barrows, M. L.... . ...1806 North High Street
Assistant Professor of German

Edwin Long Beck, M. A...................230 West Tenth Avenue
Assistant Professor of English

Thomas McDougal Hills, B. Ph..................1942 Iuka Avenue
Assistant Professor of Geology

Ludwig Lewisohn, M. A., Litt. D... ....14 Twelfth Avenue
Assistant Professor of German

Robert Oscar Busey, M. A........................2090 Iuka Avenue
Assistant Professor of German

George S. Chapin, M. A...................55 East Woodruff Avenue
Assistant Professor of Romance Languages

Carl C. Harrop, E. M........... ....2326 Indianola Avenue
Assistant Professor of Ceramic Engineering

Cecil E. Boord, M. A., Ph. D................417 Thirteenth Avenue
Assistant Professor of Chemistry

Walter Peirce, M. A., Ph. D......... ....2091 Iuka Avenue
Assistant Professor of Romance Languages

George F. Schlesinger, C. E............ ......227 Fifteenth Avenue
Assistant Professor of Civil Engineering

Owen E. Williams........ ....2094 Tuller Street
Assistant Professor of Engineering Drawing

Clarence E. Andrews, Ph. D.................234 West Ninth Avenue
Assistant Professor of English

Milton Percival, Ph. D......................289 Eighteenth Avenue
Assistant Professor of English

Roscoe C. Sloane, B. Ph., C. E...................7 Twelfth Avenue
Assistant Professor of Civil Engineering

William D. Turnbull, C. E...............151 East Oakland Avenue
Assistant Professor of Engineering Drawing

Hubert L. Olin, Ph. D...........................403 King Avenue
Assistant Professor of Chemistry

Edward Kromer............ ....87 West Patterson Avenue
Assistant Professor of Engineering Drawing

Edward W. Kellogg, C. E.................1457 Worthington Street
Assistant Professor of Electrical Engineering

J. Ernest Carman, Ph. D................. .....17 Twelfth Avenue
Assistant Professor of Geology

Heinrich C. Keidel, Ph. D..................196 West Sixth Avenue
Assistant Professor of German

Harry E. Nold, E. M.. ....1619 Highland Street
Assistant Professor of Mine Engineering

John H. Nichols, B. A., M. D..................1509 Summit Street
Assistant Professor of Physical Education

INSTRUCTORS

Frank H. Haskett...................... ....380 King Avenue
Instructor in Architecture

Wilbert C. Ronan, C. E. (Arch.), B. Sc. (Arch.)..47 Twelfth Avenue
Instructor in Architecture

William J. Norris..... ....60 East Eighth Avenue
Instructor in Art

Robert C. Hummell, M. A............. .....139 West Ninth Avenue
Instructor in Chemistry

James H. Young, B. Sc........................ 2080 Peasley Street
Instructor in Chemistry

Orland R. Sweeney, B. Sc. (Chem.), Ph. D.........354 King Avenue
Instructor in Chemistry

Wilhelm Neilson, B. Sc. in C. E...........3100 North High Street
Instructor in Civil Engineering

Carl G. Faehnle..............................385 Buttles Avenue
Instructor in Civil Engineering

John E. Shepardson, B. Sc. ....Granville, Ohio
Instructor in Electrical Engineering

Roy A. Brown, M. E. in E. E................2074 Peasley Street
Instructor in Electrical Engineering

Edward J. Gilbert, M. E....................66 Chittenden Avenue
Instructor in Engineering Drawing

Carl L. Svensen, B. Sc......................1516 Highland Street
Instructor in Engineering Drawing

Tada Y. Inagaky, M. E. in E. E........ ....1066 Neil Avenue
Instructor in Engineering Drawing

J. Forest Craig, M. A..........................1273 Summit Street
Instructor in English

Charles G. Dishong, B. Sc. (Edu.), M. A......75 West Tenth Avenue
Instructor in English

Earl W. Wiley, B. A.............................438 King Avenue
Instructor in English

Gertrude L. Robinson, B. A......... ....Worthington, Ohio
Instructor in English

Marjorie L. McCutcheon, B. Ph...........41 West Eleventh Avenue
Instructor in English

Charles F. Lindsley, B. A..................84 West Fourth Avenue
Instructor in English

Frederick W. Moore, B. A..................255 West Tenth Avenue
Instructor in English

Louis Foley, B. A. .... 16 Alhambra Court
Instructor in English

Theodore F. Kotz, M. A. ....
Instructor in German

Heinrich W. Reese, B. A. .... 1293 Neil Avenue
Instructor in German

Allando A. Case .... 347 West Tenth Avenue
Instructor in Industrial Arts

Clement M. Beem .... 1872 Summit Street
Instructor in Industrial Arts

Jacob A. Foust .... 21 West Frambes Avenue
Instructor in Industrial Arts

Ulysses W. Denman .... 505 Chilcote Avenue
Instructor in Industrial Arts

Aubrey I. Brown, M. E. .... 210 Thirteenth Avenue
Instructor in Mechanical Engineering

Jasper O. Draffin, B. Sc. in C. E., M. Sc. .... 315 West Ninth Avenue
Instructor in Mechanics

Earl C. Smith, E. M. .... 79 East Frambes Avenue
Instructor in Metallurgy

Henry C. Ohlson .... 16 West Tenth Avenue
Instructor in Physical Education.

Allison W. Marsh, B. A. .... 70 Twelfth Avenue
Instructor in Physical Education

George M. Trautman, B. Sc. (Forestry) .... 1902 North High Street
Instructor in Physical Education

Dwight A. Woodbury, M. Sc. .... 308 Nineteenth Avenue
Instructor in Physics

Herman C. Heil, B. Ph. .... 323 West Ninth Avenue
Instructor in Physics

Alva W. Smith, M. A. .... 127 East Eleventh Avenue
Instructor in Physics

Jay K. Ditchy, M. A. .... 30 Fourteenth Avenue
Instructor in Romance Languages

Alexander P. Moore, M. A. .... 1981 Indianola Avenue
Instructor in Romance Languages

Leopold Cardon, B. ès Lettres.............2425½ North High Street
Instructor in Romance Languages

Phillip Teixido de Berriz, B. A..... ....71 Sixteenth Avenue
Instructor in Romance Languages

ASSISTANTS

Homer B. Adkins, M. A .... 133 West Ninth Avenue
Assistant in Chemistry

Emil H. J. Balz, M. Sc.....................964 South High Street
Assistant in Chemistry

Marion Hollingsworth, M. A...............1562 Worthington Street
Assistant in Chemistry

Carl R. McCroskey, B. A..................93 West Eighth Avenue
Assistant in Chemistry

Edward Schmidt, M. A......................75 West Tenth Avenue
Assistant in Chemistry

Gebhard Stegeman, M. A...................22 Fifteenth Avenue
Assistant in Chemistry

John C. Bowman, B. Sc. (Pharm.)........70 West Norwich Avenue
Assistant in Chemistry

Herbert S. Coith, B. Sc.....................22 Fifteenth Avenue
Assistant in Chemistry

Evan L. Mahaffey, M. A...............242 East Northwood Avenue
Assistant in Chemistry

Albert F. Puchstein...............................1576 Neil Avenue
Assistant in Electrical Engineering

Troi O. Farmer, M. E. in E. E..........27 East Patterson Avenue
Assistant in Electrical Engineering

Samuel S. Withrow. ....417 Eighteenth Avenue
Assistant in Engineering Drawing

Oren W. Hankins, B. A. ....235 West Tenth Avenue
Assistant in English

Edith M. Sniffen, B. A...... ....41 West Eleventh Avenue
Assistant in English

James F. Fullington, B. A......................288 Fifteenth Avenue
Assistant in English

Walter French, M. A. .... 1342 Forsythe Avenue
Assistant in German

John J. Breckur .... 1133 Highland Street
Assistant in Industrial Arts

Perry L. Wright .... 139 West Lane Avenue
Assistant in Industrial Arts

Robert E. Smith .... Westerville, Ohio
Assistant in Industrial Arts

Harold Wright .... 963 Sullivant Avenue
Assistant in Industrial Arts

Carl M. Senn .... 1481 Worthington Street
Assistant in Industrial Arts

Hortense Rickard, M. A. .... 333 West Tenth Avenue
Assistant in Mathematics

H. Halouk Fikret, B. S. E. in M. E., A. R. C. 137 West Tenth Avenue
Assistant in Mechanical Engineering

Ray Ellis, B. M. E. .... 2230 North High Street
Assistant in Mechanical Engineering

Karl W. Stinson, B. M. E. .... 62 West Tenth Avenue
Assistant in Mechanical Engineering

Jerry H. Service, Jr., B. Sc. in E. E. .... 27 West Blake Avenue
Assistant in Physics

Charles W. Jarvis, B. Sc., B. A. .... 166 West Tenth Avenue
Assistant in Physics

George S. Pierce, B.Sc. (Edu.) .... 2134 Indianola Avenue
Assistant in Physics

Charles B. Joliffe, B. Sc. .... 146 West Eighth Avenue
Assistant in Physics

John S. Ward, B. Sc .... 1038 Michigan Avenue
Assistant in Physics

John G. Albright, B. A. .... 37 Chittenden Avenue
Assistant in Physics

Benjamin F. Salisbury .... 238 King Avenue
Assistant in Physics

THE OHIO STATE UNIVERSITY

The Ohio State University, located in Columbus, is a part of the public educational facilities maintained by the State.

ORGANIZATION

For convenience of administration, the departments of the University are grouped into organizations called colleges. The Ohio State University comprises eleven colleges and a graduate school, each under the administration of a Dean and College Faculty, as follows:

Graduate School
College of Agriculture
College of Arts, Philosophy and Science
College of Commerce and Journalism
College of Dentistry
College of Education
College of Engineering
College of Homœopathic Medicine
College of Law
College of Medicine
College of Pharmacy
College of Veterinary Medicine

SUMMER SESSION

In addition to the above, there is a Summer Session under the supervision of a Director and governing committee for the administration of the regular University courses offered in the summer.

This Bulletin of announcements is devoted exclusively to the work of the College of Engineering, offered during the academic year beginning September, 1917.

(*Note*—The University publishes a bulletin descriptive of each college. Copies may be obtained by addressing L. E. Wolfe, Secretary of the Entrance Board, Ohio State University, Columbus, Ohio, and stating the college in which the writer is interested.)

THE COLLEGE OF ENGINEERING

The purpose of the College of Engineering is to instruct students in the fundamental sciences and arts, upon which all engineering rests, and to impart such special and technical knowledge of the various branches of engineering as will enable its graduates to enter them and maintain themselves while gaining their professional experience. To accomplish this purpose, the work of the College is classified under nine curricula, which are described on the following pages and which lead to the following degrees:

Bachelor of Architecture (B. Arch.)
Bachelor of Architectural Engineering (B. Arch. E.)
Bachelor of Ceramic Engineering (B. Cer. E.)
Bachelor of Chemical Engineering (B. Ch. E.)
Bachelor of Civil Engineering (B. C. E.)
Bachelor of Electrical Engineering (B. E. E.)
Bachelor of Mechanical Engineering (B. M. E.)
Bachelor of Engineering in Mining (B. E. M.)
Bachelor of Engineering (B. E.)

The curriculum leading to the degree of B. E. is offered for the benefit of those students who may desire instruction not included in any one of the special curricula, and also for those who may wish an opportunity to pursue a limited number of cultural studies, together with elective engineering studies. It is believed, however, that the severe mental discipline of any of these curricula makes the work of the College of Engineering the equal of any other in general educational value.

FIVE-YEAR CURRICULUM

For the benefit of those who are unable to carry the full schedule, on account of outside work for self-support, impaired health, or any other valid reason, any of the regular curricula can be rearranged to cover five instead of four years.

COMBINATION CURRICULA

It is also possible to arrange combination curricula leading to two degrees in five or more years. (See page 28)

GRADUATE COURSES

Advanced courses in various engineering subjects are offered by the Departments of the College of Engineering, to those who wish to pursue them. If such courses are pursued with the expectation of receiving credit upon them to apply towards any higher degree, the student must register in the Graduate School, under whose jurisdiction all work for the higher degrees is conducted. For further information, consult the Bulletin of the Graduate School of the University or confer with the Dean or Secretary.

TWO-YEAR CURRICULA

The following two-year or short curricula, do not lead to a degree, but students completing them are furnished a formal certificate stating the work they have accomplished.

Clay-working
Industrial Arts
Mining

ADMISSION

The college is open on equal terms to both sexes. Applicants for admission must be at least seventeen years of age.

THE ENTRANCE BOARD

The admission of students to the University is in charge of the Entrance Board, which determines the credit that shall be issued on all entrance examinations and certificates, and furnishes all desired information to applicants. Correspondence relating to admission should be addressed to the Secretary of the Entrance Board, Ohio State University, Columbus, Ohio.

REQUIREMENTS

To obtain full standing in the College of Engineering, an applicant under twenty-one years of age must be a graduate of a high school of the first-grade or must receive credit by examination for fifteen units.

Of these fifteen units, not less than three shall be in English; three in mathematics (including solid geometry); one in physics; four in languages (other than English); and four shall be elective, and may include any subject given by any first-grade high school.

In case of schools in which manual training is especially recommended, two units of foreign language may be replaced by two units of manual training or mechanical drawing.

No student under twenty-one years of age will be admitted to college if he is conditioned in more than two of the fifteen units. An applicant twenty-one years of age or over may be admitted with a total deficiency of four units. Of these four units, all may be in foreign language, but not more than two units may be in subjects other than foreign language.

The requirements for admission to the College of Engineering are stated in detail in the *Bulletin of General Information.*

For admission by examination see page 25, by certificate see page 26 of the *Bulletin of General Information.*

ADMISSION TO TWO-YEAR CURRICULA

Applicants must be at least seventeen years of age and unless they are over twenty-one years of age must have credit by examination or certificate for the common branches. In addition, each applicant under twenty-one years of age must present a letter or certificate showing that he has had at least two years' consecutive practical experience in some industry related to the course which he wishes to pursue, and this certificate must be satisfactory to the Executive Committee of the College of Engineering.

CURRICULA

OUTLINE OF THE FIRST YEAR'S WORK OF ALL FOUR-YEAR CURRICULA

In order to permit all engineering students to have a year in which to find out definitely what courses they desire to pursue, the first year of all engineering curricula except Architecture, is made uniform. While students are asked to indicate their choice on entering the College, they can change at the end of the first year without any inconvenience.

Note—The figure in parenthesis following the name of each study indicates the number of the study in its department; the other figure indicates the number of credit hours.

First Semester		Second Semester	
Mathematics (131) College Algebra and Trigonometry	5	Mathematics (132) Trigonometry and Analytics	5
Chemistry (105 or 109)* General Chemistry	4	Chemistry (106 or 110)* General Chemistry and Qualitative Analysis	4
Modern Language French, German or Spanish	4	Modern Language French, German or Spanish	4
English (101) Paragraph Writing	2	English (104) Paragraph Writing	2
Engineering Drawing (101) Elementary Mechanical	2	Engineering Drawing (102) Lettering and Projections	3
Military Drill	1	Military Drill	1
Physical Education	1	Physical Education	1

SUMMER SESSION

Shopwork is required in the Summer Session in all Engineering curricula except Architecture and Civil Engineering. In Electrical, Mechanical, and Mine Engineering, the shopwork courses (109) and (115) are required at the end of the first year. In Chemical Engineering, the same courses are required, but may be taken at the end of the first or second year. In Ceramic Engineering and in General Engineering, Shopwork (107), (109), and (115) are offered and two of these must be taken at the end of the first year.

---

*Students presenting Chemistry as an entrance subject will take Chemistry 109 and 110. Students with no entrance credits in Chemistry will take Chemistry 105 and 106.

ARCHITECTURE

FIRST YEAR

FIRST SEMESTER			SECOND SEMESTER		
Mathematics College Algebra and Trigonometry	(131)	5	Mathematics Trigonometry and Analytics	(132)	5
French	(101 or 103)	4	French	(102 or 106)	4
English Paragraph Writing	(101)	2	English Paragraph Writing	(104)	2
Engineering Drawing Elementary Mechanical	(101)	2	Engineering Drawing Lettering and Projections	(102)	3
Art Elementary Drawing	(131)	2	Art Elementary Drawing	(132)	2
Architecture Elements of Architecture	(131)	2	Architecture Elements of Architecture	(132)	2
Military Drill		1	Military Drill		1
Physical Education		1	Physical Education		1

SECOND YEAR

Mathematics Calculus	(127)	3	Mathematics Calculus	(128)	3
Physics General Physics	(117)	2	Physics General Physics	(118)	2
Engineering Drawing Descriptive Geometry	(107)	3	Architecture Shades, Shadows and Perspective	(124)	3
Art Advanced Drawing	(133)	2	Art Elementary Design	(141)	2
Architecture History of Architecture	(133)	3	Architecture History of Architecture	(134)	3
Architecture Design	(141)	5	Architecture Design	(142)	5
Military Drill		1	Military Drill		1

SUMMER COURSE—Architecture (121), Architectural Practice, or an Architectural Problem. Four credit hours.

THIRD YEAR

Mechanics Statics and Strength of Materials	(103)	5	Civil Engineering Trusses	(124)	3
Art Water Color	(161)	2	Art Advanced Water Color	(162)	2
Architecture Architectural Composition	(113)	2	Architecture Wood Construction	(150)	5
Architecture Photography	(111)	2	Architecture History of Architecture	(136)	3
Architecture History of Architecture	(135)	2	Architecture Design	(144)	5
Architecture Design	(143)	5			

SUMMER COURSE—Architecture (121), Architectural Practice, or an Architectural Problem. Four credit hours.

FOURTH YEAR

FIRST GIVEN IN 1918-1919

FIRST SEMESTER			SECOND SEMESTER		
Mechanical Engineering Heating and Ventilating	(121)	3	Civil Engineering Cement and Concrete	(130)	2
Architecture Plumbing	(117)	1	Architecture Professional Practice	(116)	4
Architecture Masonry	(151)	3	Architecture Thesis	(118)	5
Architecture Ornament	(147)	4	Architecture Design	(146)	5
Architecture Design	(145)	5	Art Drawing from Life	(164)	2
Art Drawing from Life	(163)	2			

ARCHITECTURAL ENGINEERING

FOR FIRST YEAR, SEE PAGE 16

SECOND YEAR

Mathematics Calculus	(141)	5	Mathematics Calculus	(142)	5
Physics General Physics	(111)	3	Physics General Physics	(112)	3
Engineering Drawing Descriptive Geometry	(107)	3	Architecture Shades, Shadows and Perspective	(124)	3
Architecture Elements of Architecture	(131)	2	Architecture Elements of Architecture	(132)	2
Architecture History of Architecture	(133)	3	Architecture History of Architecture	(134)	3
Art Elementary Drawing	(131)	2	Art Elementary Drawing	(132)	2
Military Drill		1	Military Drill		1

SUMMER COURSE—Architecture (120), Architectural Practice, or an Architectural Problem. Four credit hours.

THIRD YEAR

Mechanics Statics and Strength of Materials	(103)	5	Mechanics Strength of Materials	(104)	2
Mechanical Engineering Materials of Construction	(123)	2	Civil Engineering Trusses	(124)	3
Architecture Architectural Composition	(113)	2	Architecture Photography	(111)	2
Architecture History of Architecture	(135)	2	Architecture Wood Construction	(150)	5
Architecture Design	(141)	5	Architecture Design	(142)	5
Electrical Engineering Illumination	(117)	2			

SUMMER COURSE—Architecture (121), Architectural Practice, or an Architectural Problem. Four credit hours.

FOURTH YEAR

FIRST GIVEN IN 1918-1919

FIRST SEMESTER			SECOND SEMESTER		
Mechanical Engineering Heating and Ventilating	(121)	3	Civil Engineering Cement and Concrete	(130)	2
Mechanical Engineering Experimental Engineering Laboratory	(169)	2	Civil Engineering Surveying	(128)	2
Architecture Plumbing	(153)	2	Architecture Professional Practice	(116)	4
Architecture Masonry	(151)	3	Architecture Thesis	(118)	5
Architecture Design	(143)	5	Architecture Fire Protection	(123)	2
Civil Engineering Tall Buildings	(125)	3	Civil Engineering Concrete Design	(129)	3

ARCHITECTURE AND ARCHITECTURAL ENGINEERING

FOURTH YEAR

GIVEN ONLY IN 1917-1918

Architecture Design	(115)	4	Architecture Design	(114)	3
Architecture Plumbing	(117)	1	Architecture Professional Practice	(116)	4
Architecture Masonry	(119)	2	Civil Engineering Surveying	(128)	2
Architecture Fire Protection	(123)	2	Civil Engineering Cement and Concrete	(118)	3
Architecture Architectural Rendering	(125)	2	Architecture Thesis	(118)	5
Civil Engineering Tall Buildings	(125)	3			
Mechanical Engineering Materials of Construction	(123)	2			
Mechanical Engineering Heating and Ventilating	(121)	2			

CERAMIC ENGINEERING

FOR FIRST YEAR, SEE PAGE 16

SECOND YEAR

Mathematics Calculus	(141)	5	Mathematics Calculus	(142)	5
Physics Mechanics and Heat	(111)	3	Physics Electricity, Light and Sound	(112)	3
Engineering Drawing Descriptive Geometry	(103)	3	Engineering Drawing Machine Sketching	(104)	3
Ceramic Engineering Ceramic Chemistry	(101)	4	Ceramic Engineering Laboratory	(102)	4
Ceramic Engineering Clays	(141)	3	Ceramic Engineering Clay Wares	(142)	3
Military Drill		1	Military Drill		1

THIRD YEAR

FIRST SEMESTER			SECOND SEMESTER		
Mechanics Statics and Strength of Materials	(101)	5	Mechanics Strength of Materials	(104)	2
Chemistry Physical Chemistry	(159)	3	Geology	(168)	3
Mine Engineering Mine Surveying	(103)	4	Civil Engineering Trusses	(124)	3
Ceramic Engineering Drying and Burning	(143)	3	Ceramic Engineering Decoration of Clay Wares	(144)	3
Ceramic Engineering Calculations	(105)	2	Ceramic Engineering Physical, Chemical Measurements	(108)	3
Mine Engineering Mine Trip	(109)	1	Mechanical Engineering Mechanism and Design	(110)	3

FOURTH YEAR

Ceramic Engineering Laboratory	(111)	5	*Ceramic Engineering Laboratory	(112)	5
Ceramic Engineering Drawing	(113)	5	Ceramic Engineering Drawing	(114)	5
Metallurgy Fuel	(117)	2	*Ceramic Engineering Cement Lectures	(118)	5
Metallurgy Iron and Steel	(119)	2	Civil Engineering Cement and Concrete	(118)	3
Metallurgy Pyrometry	(125)	1	Ceramic Engineering Thesis	(116)	4
Mineralogy Physical Chemical Mineralogy	(105)	2			

CHEMICAL ENGINEERING

FOR FIRST YEAR, SEE PAGE 16

SECOND YEAR

Mathematics Calculus	(141)	5	Mathematics Calculus	(142)	5
Physics General Physics	(111)	3	Physics General Physics	(112)	3
Engineering Drawing Descriptive Geometry	(103)	3	Engineering Drawing Machine Sketching	(104)	3
Chemistry Quantitative Analysis	(119)	4	Chemistry Quantitative Analysis	(120)	4
Chemistry Advanced General Chemistry	(113)	2	Chemistry Advanced General Chemistry	(114)	2
Military Drill		1	Chemistry Chemical Problems	(124)	1
			Military Drill		1

---

*Alternative courses. One must be taken.

THIRD YEAR

FIRST SEMESTER			SECOND SEMESTER		
Mechanics Statics and Strength of Materials	(101)	5	Mechanics Kinetics and Hydraulics	(102)	5
Engineering Drawing Technical Drawing	(121)	2	Engineering Drawing Technical Drawing	(122)	2
Metallurgy Fuel	(117)	2	Mineralogy Mineralogy and Crystallography	(102)	3
Metallurgy Iron and Steel	(119)	2	Chemistry Organic Chemistry, lectures	(152)	2
Chemistry Organic Chemistry, lecture	(151)	2	Elective		5 to 7
Chemistry Organic Chemistry, lab.	(153)	2			
Mechanical Engineering Steam Engineering	(107)	3			

Electives in third year, second semester must be chosen from the following courses, subject to approval of the departments concerned: Chemistry (136) 2, Chemical Literature; Chemistry (154) 2 or 3, Advanced Organic Chemistry; Chemistry (168) 3 to 5, Advanced Qualitative Analysis; Chemistry (176) 3, Sanitary Analysis; Chemistry (187) 2 or 3, Inorganic Preparations; Chemistry (192) 2, Rare Elements: (given only in odd numbered years); Metallurgy (110 4, General Metallurgy; Metallurgy (112) 2, Calorimetry and Mine Gas Analysis.

FOURTH YEAR

Mechanical Engineering Machine Design	(127)	5	Mechanical Engineering Machine Design	(144)	5
Chemistry Physical Chemistry	(157)	3	Chemistry Physical Chemistry	(158)	3
Chemistry Industrial Chemistry	(177)	2	Chemistry Industrial Chemistry	(178)	1
Chemistry Industrial Chemistry, laboratory	(185)	2	Chemistry Industrial Chemistry, laboratory	(186)	3
Electrical Engineering Elementary Electrical Engineering	(101)	5	Chemistry Thesis	(140)	4
			Chemistry Inspection Trip	(182 or 184)	1
			Elective		2

CIVIL ENGINEERING

FOR FIRST YEAR, SEE PAGE 16

SECOND YEAR

FIRST SEMESTER			SECOND SEMESTER		
Mathematics Calculus	(141)	5	Mathematics Calculus	(142)	5
Physics General Physics	(111)	3	Physics General Physics	(125)	5
Engineering Drawing Descriptive Geometry	(105)	3	Engineering Drawing Advanced Descriptive Geometry	(106)	3
Civil Engineering Land Surveying and Field Practice	(101 & 101a)	4 and 1	Civil Engineering R. R. Surveying and Field Practice	(102 & 102a)	4 and 1
Civil Engineering Topographic Drawing	(103)	2	Military Drill		1
Military Drill		1			

SUMMER COURSES—Civil Engineering (104 and 111), each four weeks of six days per week. Four credit hours for each course. Field work in surveying. Required in second and third years respectively.

THIRD YEAR

Astronomy Geodesy and Least Squares	(104)	3	Astronomy Geodesy and Least Squares	(105)	3
Mechanics Statics and Strength of Materials	(101)	5	*Electrical Engineering	(103)	3
Civil Engineering Topographic Surveying	(105)	3	Mechanics Kinetics and Hydraulics	(102)	5
Civil Engineering Applied Descriptive Geometry	(107)	2	Civil Engineering Timber Construction	(108)	3
Civil Engineering Sanitary Engineering	(109)	3	Civil Engineering Roads and Pavements	(106)	3
Geology	(168)	3	[1]Civil Engineering Stresses in Structure	(110)	4
			[2]Civil Engineering Trusses	(124)	3
			[2]Civil Engineering Engineering Reports	(138)	1

---

[1] Civil Engineering group.

[2] Municipal and Sanitary Engineering group.

*Alternative with Astronomy 105 in Municipal and Sanitary Engineering group.

FOURTH YEAR

CIVIL ENGINEERING GROUP

FIRST SEMESTER

Civil Engineering Bridge Design	(113)	4
Civil Engineering Cement and Concrete	(130)	2
Civil Engineering Masonry Construction	(115)	3
Mechanical Engineering Laboratory	(173)	5
*Civil Engineering R. R. Maintenance	(141)	3
or		
*Civil Engineering Tall Buildings	(125)	3
or		
*Electrical Engineering	(103)	3

SECOND SEMESTER

*Civil Engineering Railway Location	(112)	4
or		
*Civil Engineering Advanced Bridge Design	(114)	4
Civil Engineering Water Supply	(117)	3
Civil Engineering Masonry Structures and Contracts	(116)	3
Civil Engineering Thesis	(122)	3
Civil Engineering Concrete Design	(129)	3
*Mechanical Engineering Hydraulic Machinery	(142)	2
or		
*Mechanical Engineering Hydraulic Power	(150)	3

FOURTH YEAR

MUNICIPAL AND SANITARY ENGINEERING GROUP

Civil Engineering Cement and Concrete	(130)	2
Civil Engineering Masonry Construction	(115)	3
Mechanical Engineering Laboratory	(173)	5
Civil Engineering Thesis	(119)	1
Civil Engineering Municipal Engineering	(139)	3
*Bacteriology General Bacteriology	(107)	4
or		
*Chemistry Quantitative Analysis	(119)	3

Civil Engineering Water Supply	(117)	3
Civil Engineering Masonry Structures and Contracts	(116)	3
Civil Engineering Thesis	(122)	3
Civil Engineering Concrete Design	(129)	3
Civil Engineering Sanitary and Water Supply Design	(140)	3
*Bacteriology Water Exam., Sewage Disposal Water Filtration	(114)	3
or		
*Chemistry Sanitary Analysis	(176)	3

Students will not be permitted to change groups during the senior year.

*Alternative courses.

ELECTRICAL ENGINEERING

FOR FIRST YEAR, SEE PAGE 16

SECOND YEAR

FIRST SEMESTER			SECOND SEMESTER		
Mathematics Calculus	(141)	5	Mathematics Calculus	(142)	5
Physics Mechanics and Heat	(113)	5	Physics Electricity, Light and Sound	(114)	4
Engineering Drawing Descriptive Geometry	(103)	3	Physics Laboratory	(134)	4
Physics Laboratory	(133)	2	Engineering Drawing Machine Sketching	(110)	2
Shopwork Machine Work	(119)	3	Shopwork Advanced Machine Work	(121)	3
Military Drill		1	Military Drill		1

THIRD YEAR

Mechanics Statics and Strength of Materials	(101)	5	Mechanics Kinetics and Hydraulics	(102)	5
Physics Laboratory	(135)	5	Electrical Engineering D. C. Machinery	(104)	5
Mechanical Engineering Heat Power Engineering	(105)	3	Mechanical Engineering Heat Power Engineering	(106)	3
Mechanical Engineering Mechanism	(101)	3	Mechanical Engineering Laboratory	(160)	2
Engineering Drawing Technical	(111)	2	Electrical Engineering Applications, A. C. Prin.	(106 & 108)	3
Electrical Engineering Inspection Trip	(131)				

FOURTH YEAR

Mechanical Engineering Laboratory	(175)	3	Electrical Engineering A. C. Laboratory	(112)	3
Electrical Engineering A. C. Laboratory	(111)	3	Electrical Engineering Transmission	(124)	3
Electrical Engineering A. C. Machinery	(109)	3	Industrial Arts Machine Design	(112)	2
Electrical Engineering Elec. Machine Design	(121)	3	Electrical Engineering Thesis	(128)	5
Electrical Engineering	(*)	2	Electrical Engineering Inspection Trip	(130 or 134)	
Electrical Engineering Thesis	(127)	1	Elective		2 to 5
Elective		2 to 4			

---

*One of the following: (113) Railways, (115) Telephones, (117) Illumination, (119) Wireless Telegraphy.

GENERAL ENGINEERING

FOR FIRST YEAR, SEE PAGE 16

Second Year

First Semester			Second Semester		
Mathematics Calculus	(141)	5	Mathematics Calculus	(142)	5
Chemistry Quantitative Analysis	(119)	4	*Chemistry Quantitative Analysis	(120)	4
Physics	(113)	5	Physics	(114)	4
Engineering Drawing	(103)	3	*Physics	(136)	4
Military Drill		1	Engineering Drawing	(104)	3
			Military Drill		1

(1) In addition to the two years outlined above, the student shall obtain credit for 68 semester hours in order to complete the requirements for his degree.

(2) Of these 68 hours, 10 hours must be Mechanics 101 and 102, which shall ordinarily be completed during the third year.

(3) At least 20 hours shall be selected from technical engineering subjects, and 20 hours shall be selected from either technical engineering subjects or from those sciences fundamental to engineering which are inclined in the Bulletin of the College of Engineering. These subjects must be approved by the engineering department in which the student's principal work is done, and by the Secretary of the College of Engineering.

(4) The production of a thesis shall be optional with the student, subject to the approval of the department concerned.

(5) The remaining 18 hours shall be selected from any work of the University to which the student is eligible, subject to the approval of the Engineering Department having supervision over the last two years of the student's work.

---

*Alternative courses. One must be taken.

MECHANICAL ENGINEERING

FOR FIRST YEAR, SEE PAGE 16

SECOND YEAR

FIRST SEMESTER			SECOND SEMESTER		
Mathematics Calculus	(141)	5	Mathematics Calculus	(142)	5
Physics Mechanics and Heat	(113)	5	Physics General Physics	(119)	3
Engineering Drawing Descriptive Geometry	(103)	3	Physics Laboratory	(138)	2
Shopwork Foundry	(105)	2	Engineering Drawing Machine Sketching	(104)	3
Shopwork Chipping and Filing	(107)	2	Shopwork Machine Shop	(119)	3
Shopwork Advanced Pattern Making	(111)	1	Civil Engineering Surveying	(128)	2
Military Drill		1	Military Drill		1

THIRD YEAR

Mechanics Statics and Strength of Materials	(101)	5	Mechanics Kinetics and Hydraulics	(102)	5
Engineering Drawing Technical Drawing	(111)	2	Architecture Photography	(111)	2
Metallurgy Fuel	(117)	2	Civil Engineering Timber and Masonry	(126)	2
Metallurgy Iron and Steel	(119)	2	Mechanical Engineering Mechanism	(114)	3
Mathematics Differential Equations	(151)	1	Mechanical Engineering Mechanism Drawing	(116)	1
Mechanical Engineering Steam Power Plants	(103)	3	Mechanical Engineering Laboratory	(164)	2
Shopwork Advanced Machine Shop	(121)	3	Mechanical Engineering Steam Power Plants	(104)	4

FOURTH YEAR

Civil Engineering Trusses	(124)	3	*Industrial Arts Shop Buildings	(114)	2
Electrical Engineering Elementary Elec. Engineering	(101)	5	*Mechanical Engineering Steam Turbines	(146)	2
Mechanical Engineering Machine Design	(127)	5	*Mechanical Engineering Hydraulic Power	(150)	3
Mechanical Engineering Gas Engines and Producers	(125)	2	Mechanical Engineering Machine Design	(144)	5
Mechanical Engineering Thermodynamics	(129)	2	Mechanical Engineering Hydraulic Machinery	(142)	2
Mechanical Engineering Laboratory	(179)	2	Mechanical Engineering Laboratory	(190)	6
			Mechanical Engineering Thesis	(148)	3
			Mechanical Engineering Inspection Trip	(130 or 134)	

---

*Alternative courses. One must be taken.

MINE ENGINEERING

FOR FIRST YEAR, SEE PAGE 16

SECOND YEAR

FIRST SEMESTER			SECOND SEMESTER		
Mathematics Calculus	(141)	5	Mathematics Calculus	(142)	5
Physics General Physics	(111)	3	Physics General Physics	(112)	3
Engineering Drawing Descriptive Geometry	(103)	3	Engineering Drawing Machine Sketching	(104)	3
Chemistry Quantitative Analysis	(119)	3	Metallurgy Laboratory	(106)	4
Mine Engineering Mine Surveying	(103)	4	Mineralogy Mineralogy and Crystallography	(102)	3
Military Drill		1	Mine Engineering Mine Trip	(110)	
			Military Drill		1

THIRD YEAR

Mechanics Statics and Strength of Materials	(101)	5	Mechanics Kinetics and Hydraulics	(102)	5
Metallurgy Fuel	(117)	2	Metallurgy General Metallurgy	(110)	4
Metallurgy Iron and Steel	(119)	2	Metallurgy Calorimetry, Mine Gas Analysis	(112)	2
Metallurgy Fire Assaying	(105)	3	Mineralogy Determinative Mineralogy	(104)	3
Metallurgy Laboratory	(107)	4	Geology Petrography	(166)	2
Geology General Geology	(165)	3	Civil Engineering Trusses	(124)	3

FOURTH YEAR

Mine Engineering General Mining	(105)	5	Mine Engineering General Mining	(106)	5
Metallurgy Metallurgical Construction	(111)	1	Mine Engineering Plans and Specifications	(104)	4
Metallurgy Ore Dressing	(113)	2	Mechanical Engineering Laboratory	(192)	3
Mine Engineering Metallurgical Design	(111)	1	*Mine Engineering Thesis	(116)	3
Electrical Engineering	(103)	3	*Metallurgy Thesis	(116)	
Geology Economic Geology	(167)	3	Metallurgy Metallography	(120)	2
Architecture Photography	(111)	2	Metallurgy Pyrometry and Calorimetry	(122)	1

---

*Alternative courses. One must be taken.

THESIS

As a requisite for graduation each candidate in the College of Engineering must present an acceptable thesis, embodying the results of a special study. The subject of this study must lie within the field of the degree sought. The subject must be filed with the head of the department, under whose direction the work is done, on the official blank provided for the purpose, not later than December 15, of the University year in which the degree is sought. The completed thesis must be submitted to the professor who has directed the work not later than the second Thursday before Commencement Day for final approval.

If the thesis is then approved the student shall deposit two copies of it with the University Editor not later than noon of the Friday before Commencement, and shall pay to the Editor a fee covering the cost of binding the same.

RESERVE OFFICERS' TRAINING CORPS

1. That the first two years of the various engineering curricula remain as they are at present.

2. That those students who have completed two academic years of service in the Senior Division of the Reserve Officers' Training Corps, and who have been selected for further military training by the President of the University and the Professor of Military Science and Tactics, and who execute the written agreement or contract to pursue the two years advanced curriculum, as prescribed in Section 35 of General Order No. 49, shall receive no academic credit for the prescribed physical work or military drill of said advanced curriculum, but may receive academic credit to the amount of three hours per week during four semesters for the theoretical instruction in military subjects of said curriculum.

3. That a student taking this special military training shall be allowed to substitute, during four semesters, three credit hours of military subjects for which academic credit is given, for the same number of hours of subjects which are now a part of the curriculum leading to the degree sought.

4. That the selection of the subjects in the present curricula for which military credits may be substituted shall be determined by the Executive Committee of the College and the department in which the major work of the student lies.

COMBINATION CURRICULA

Combination curricula leading to two engineering degrees, can be arranged for any two of the foregoing degrees. The amount of additional time will be at least thirty semester hours in excess of that required for one, and may be more. In no case will the student be required to take all of the work not common to the two curricula as published.

For instance a joint curriculum, Mechanical and Electrical Engineering, can be taken in five years. Where the curricula are more diverse, such as Civil Engineering and Mechanical Engineering, six years may be required.

ARTS-ENGINEERING CURRICULA

For the benefit of those who desire to possess the advantage of a wider general culture and a broader foundation than can be given in the limits of a four-year professional curriculum, a combination of three years in the College of Arts, Philosophy and Science and three years in the College of the Engineering can be so adjusted as to enable the student to secure the degree of Bachelor of Arts and the appropriate engineering degree.

The College of Engineering desires to establish similar relations with other educational institutions of approved standing in Ohio and elsewhere, by which a student can earn two degrees in five or six years.

GRADUATE WORK

The Graduate School has administrative control of the graduate work in all of the colleges of the University. The conditions under which advanced degrees can be obtained by graduates of the College of Engineering are as follows:

Master's Degree. The degree which will usually be conferred upon candidates whose major work lies in Engineering, will be that of Master of Science, (M. Sc.). The course of study will consist of one major and either one or two minors, at least one of the minors being in a different department from that in which the major is taken. A residence of one year devoted wholly to graduate work is required, but graduates of this University may complete not more than half of the required work at another institution offering equivalent opportunities for study. Except in certain special cases, a satisfactory thesis is required.

Professional Engineering Degrees. Upon nomination by the Faculty of the College of Engineering, the appropriate professional engineering degree of Ceramic Engineer, Chemical Engineer, Civil Engineer, Electrical Engineer, Engineer of Mines, Mechanical Engineer, or Master of Architecture, may be granted to graduates of this University upon any one of the following plans:

First. Four years of acceptable professional experience and an approved thesis.

Second. A Master of Science degree from this University with a major in engineering, followed by two years of acceptable professional experience and an approved thesis.

Third. One year of acceptable professional experience, followed by one year of approved study at this University, with an appropriate engineering major, and an approved thesis.

CURRICULA NOT LEADING TO A DEGREE

The following short curricula of two years each, are offered by the College of Engineering to meet the needs of that class of young men who have for some reason failed to qualify themselves to enter the regular four-year curricula, but whose experience in engineering work has shown them the need of some technical education as a requisite to further progress. These curricula are in no sense a substitute for the regular four-year curricula nor are they designed as preparation for subsequent entrance into the regular curricula. They aim to give an introduction to the fundamentals of engineering only, and in the shortest time consistent with any real educational result.

Applicants for admission to these curricula are required to have at least two years of consecutive practical experience in some branch of the industries related to the one they wish to pursue, and to present a satisfactory certificate to that effect. (See the *Bulletin of General Information*, page 35.)

TWO-YEAR CURRICULA

CLAYWORKING

FIRST YEAR

FIRST SEMESTER

Mathematics Elementary Algebra	(101)	5
Chemistry Elementary Chemistry	(101)	4
Engineering Drawing Freehand and Lettering	(113)	4
Ceramic Engineering Occurrence and Winning of Clays	(141)	3
Military Drill		1
Physical Education		1

SECOND SEMESTER

Mathematics Elementary Algebra	(102)	5
Chemistry Elementary Chemistry and Qualitative Analysis	(102)	4
Engineering Drawing Mechanical Drawing	(114)	3
Ceramic Engineering Preparation and Forming of Clay Wares	(142)	3
Military Drill		1
Physical Education		1

SUMMER SESSION—*Students are required to take two of the following subjects: Shopwork (107), (109), and (115), during the Summer Session at the close of the first year.

SECOND YEAR

Ceramic Engineering Ceramic Chemistry	(101)	4
Ceramic Engineering Drying and Burning of Clay Wares	(143)	3
Ceramic Engineering Calculations	(105)	2
Ceramic Engineering Laboratory	(115)	2
Physics Elementary Physics	(101)	6
Military Drill		1

Ceramic Engineering Ceramic Chemistry	(102)	3
Ceramic Engineering Glazing and Decorating of Clay Wares	(144)	3
Ceramic Engineering Laboratory	(126)	5
Ceramic Engineering Dryer and Kiln Design	(122)	4
Military Drill		1

---

*Upon presentation of reasons satisfactory to the head of the department students may substitute work in a ceramic factory for the above shopwork courses.

INDUSTRIAL ARTS

FIRST YEAR

FIRST SEMESTER			SECOND SEMESTER		
Mathematics Elementary Algebra	(101)	5	Mathematics Elementary Algebra	(102)	5
Mathematics Plane and Solid Geometry	(113)	5	Mathematics Solid Geometry, Trigonometry	(114)	5
Engineering Drawing Freehand and Lettering	(113)	4	Engineering Drawing Mechanical Drawing	(114)	3
Shopwork Pattern Making	(109)	2	Shopwork Advanced Pattern Making	(111)	1
Shopwork Forging	(115)	2	Shopwork Foundry	(105)	2
Military Drill		1	Shopwork Chipping and Filing	(107)	2
Physical Education		1	Military Drill		1
			Physical Education		1

SECOND YEAR

Engineering Drawing Descriptive Geometry	(103)	3	Engineering Drawing Machine Sketching	(104)	3
Chemistry Elementary Chemistry	(101)	4	Chemistry Elementary Chemistry	(102)	4
Physics Elementary Physics	(101)	6	Industrial Arts Machines	(101)	3
Shopwork Machine Work	(119)	3	Industrial Arts Designing	(103)	1
Military Drill		1	Shopwork Advanced Machine Work	(121)	3
			Shopwork Advanced Pattern Making	(130)	3
			Military Drill		1

MINING

FIRST YEAR

FIRST SEMESTER			SECOND SEMESTER		
Mathematics Elementary Algebra	(101)	5	Mathematics Elementary Algebra	(102)	5
Mathematics Plane and Solid Geometry	(113)	5	Mathematics Solid Geometry, Trigonometry	(114)	5
Physics Elementary Physics	(101)	6	Shopwork Forging	(115)	2
Military Drill		1	Geology Elementary Physiography	(162)	4
Physical Education		1	Military Drill		1
			Physical Education		1

SECOND YEAR

Engineering Drawing Freehand and Lettering	(113)	4	Engineering Drawing Mechanical Drawing	(114)	3
Chemistry Elementary Chemistry	(101)	4	Geology Elementary Geology	(164)	3
Mine Engineering Mine Plans	(107)	2	Metallurgy Water Supply and Mine Gases	(102)	4
Mine Engineering Mine Surveying	(101)	5	Mine Engineering General Mining	(102)	5
Military Drill		1	Military Drill		1

DEPARTMENTS OF INSTRUCTION

ARCHITECTURE

Office, 105 Brown Hall

PROFESSORS BRADFORD AND CHUBB,
MR. HASKETT, MR. RONAN

131. Elements of Architecture. Two credit hours. First semester. Architecture, first year; Architectural Engineering, second year. Concurrent with Art 131, Engineering Drawing 101.

132. Elements of Architecture. Two credit hours. Second semester. Architecture, first year; Architectural Engineering, second year. Prerequisite, Architecture 131, and concurrent with Art 132 and Engineering Drawing 102.

133. History of Architecture. Three credit hours. First semester. Architecture and Architectural Engineering, second year. Concurrent, Architecture 131 and Art 131.

134. History of Architecture. Three credit hours. Second semester. Architecture and Architectural Engineering, second year. Prerequisite, Architecture 133.

135. History of Architecture. Two credit hours. First semester. Architecture and Architectural Engineering, third year. Prerequisite, Architecture 134.

History of Renaissance architecture.

136. History of Architecture. Three credit hours. Second semester. Architecture, third year. Prerequisite, Architecture 135.

History of modern architecture.

141. Design. Five credit hours. First semester. Architecture, second year; Architectural Engineering, third year. Prerequisite, Architecture 132.

142. Design. Five credit hours. Second semester. Architecture, second year; Architectural Engineering, third year. Prerequisite, Architecture 141.

150. Wood Construction. Five credit hours. Second semester. Architecture and Architectural Engineering, third year. Prerequisite, Architecture 141 and Mechanics 103.

143. Design. Five credit hours. First semester. Architecture, third year; Architectural Engineering, fourth year. Prerequisite, Architecture 142.

144. Design. Five credit hours. Second semester. Architecture, third year. Prerequisite, Architecture 143.

145. Design. Five credit hours. First semester. Architecture, fourth year. Prerequisite, Architecture 144.

146. Design. Five credit hours. Second semester. Architecture, fourth year. Prerequisite, Architecture 145.

123. Fire Protection. Two credit hours. Second semester. Architectural Engineering, fourth year. Concurrent, Civil Engineering 125.

151. Masonry. Three credit hours. First semester. Architecture and Architectural Engineering, fourth year. Prerequisite, Architecture 150.

147. Ornament. Four credit hours. First semester. Architecture, fourth year. Prerequisite, Architecture 144 and 113.

153. Plumbing. Two credit hours. First semester. Architectural Engineering, fourth year.

111. Photography. Two credit hours. Either semester. Architecture, Architectural Engineering, Mechanical Engineering, and Civil Engineering, third year; Mine Engineering, fourth year. Prerequisite, Chemistry 105-106, or 109-110. Mr. Haskett.

113. Principles of Architectural Composition. Two credit hours. First semester. Architecture, third year. Prerequisite, Architecture 134. Mr. Chubb.

116. Professional Practice. Four credit hours. Second semester. Architecture, fourth year. Prerequisite, Architecture 151. Mr. Bradford.

117. Sanitary Plumbing. One credit hour. First semester. Architecture, fourth year. Mr. Bradford.

118. Thesis. Five credit hours. Second semester. Architecture, fourth year. Mr. Bradford, Mr. Chubb, Mr. Ronan.

120. Summer Work. Four credit hours. The equivalent of four weeks of work in an architect's office, or a problem in design assigned by the department. Between the second and third years.

121. Summer Work. Four credit hours. The equivalent of four weeks of work in an architect's office, or a problem in design assigned by the department. Between the third and fourth years.

122. Photography. Two credit hours. Second semester. Prerequisite, Architecture 111. Mr. Haskett.

124. Shades, Shadows, and Perspective. Three credit hours. Second semester. Architecture, second year. Prerequisite, Engineering Drawing 107. Mr. Ronan.

FOR GRADUATES

201-202. Architecture.

203-204. Architecture. Research Work.

For description of graduate courses in this department see the Bulletin of the Graduate School.

ART

Office, 203 Hayes Hall

PROFESSOR KELLEY, MISS ROBINSON, MISS SHEPHERD,
MR. NORRIS, MR. CHRISTENSEN

131-132. Elementary Drawing. Two credit hours. The year. Four laboratory hours each week. Architecture, second year.

This course is designed to develop a thorough knowledge of form and values in black and white, also the use of freehand perspective.

Art 131 is given also during the second semester.

133. Advanced Drawing. Two credit hours. Either semester. Four laboratory hours each week. Architecture, third year. Prerequisite, Art 131-132.

This course is designed to give the student some freedom in the use of drawing as a medium of expression. Drawing from the antique and the costume model.

141. Elementary Design. Two credit hours. Either semester. Prerequisite, Art 131.

The principles of the theory and practice of design.

161-162. Water Color. Two credit hours. The year. Architecture, third year. Prerequisite, Art 133.

163-164. Drawing from Life. Two credit hours. The year. Architecture, fourth year.

ASTRONOMY

Office, Emerson McMillin Observatory

PROFESSOR LORD, ASSOCIATE PROFESSOR MANSON

104-105. Astronomy, Geodesy, and Least Squares. Three credit hours. The year. Civil Engineering, third year. Prerequisite, the calculus. Mr. Lord, Mr. Manson.

107-108. Advanced Astronomy.

109-110. The Theory of Lenses.

111-112. Introduction to Celestial Mechanics.

For description of graduate courses in this department see the Bulletin of the Graduate School.

CERAMIC ENGINEERING

Office, 26 Lord Hall

PROFESSOR WATTS, RESEARCH PROFESSOR ORTON, ASSISTANT PROFESSOR HARROP, MR. LYSATT

101. Ceramic Chemistry. Four credit hours. First semester. Ceramic Engineering and Short Clayworking, second year. Prerequisite, Chemistry 106 or 110.

Quantitative analysis of limestone and simple minerals.

102. Ceramic Chemistry. Four credit hours. Second semester. Ceramic Engineering, second year. Prerequisite, Ceramic Engineering 101.

Quantitative analysis of clays, fire-gases, etc.

105. Ceramic Calculations. Two credit hours. First semester. Ceramic Engineering, third year; Short Clayworking, second year. Prerequisite, Ceramics 101. Mr. Harrop.

Calculations involved in blending of ingredients used in ceramic mixtures; determinations of limits of variation in given series; limits of errors; volume calculations; problems in heat.

108. Physical and Chemical Measurements of Clays. Three credit hours. Second semester. Ceramic Engineering, third year. Mr. Watts.

Application of physical chemical laws to fusions of mineral mixtures; determination of melting points; deformation periods; relative viscosity of fused magmas; study of influence of salts on viscosity of slips; etc.

111-112. Laboratory Work in Ceramics. Five credit hours. The year. Ceramic Engineering, fourth year. Prerequisite, Ceramics 108 and 144. Mr. Watts.

Practice in clay testing and measurement of physical properties of clays; the production of bodies made from single clays and of clays with minerals. In each case the bodies are burned and tested. The production of slips, engobes, and glazes, and the study of the methods of coloring.

113-114. Ceramic Designing. Five credit hours. The year. Ceramic Engineering, fourth year. Prerequisite, Ceramics 144. Mr. Harrop.

Designing, estimating cost of, and writing specifications for kilns and dryers.

The work started in Ceramics 113 is extended to the design and equipment of clayworking plants.

115. Laboratory Work in Ceramics. Two credit hours. First semester. Short Clayworking, second year. Concurrent, Ceramics 143. Mr. Watts.

Testing of clays and minerals employed in clay manufacture and in blending of same for ceramic purposes.

116. Thesis. Four credit hours. Second semester. Ceramic Engineering, fourth year.

118. Cement Manufacture. Five credit hours. Second semester. Alternative with Ceramics 112, Ceramic Engineering, fourth year. Prerequisites, Ceramics 102 and 144. Mr. Harrop.

The theory of hydraulicity, the compounding, manufacture, and testing of natural and Portland cements, and other hydraulic bodies.

122. Dryer and Kiln Design. Four credit hours. Second semester. Short Clayworking, second year. Prerequisite, Ceramics 105. Mr. Harrop.

A graphic study of dryer and kiln design.

126. Laboratory Work in Ceramics. Five credit hours. Second semester. Short Clayworking, second year. Prerequisite, Ceramics 115. Mr. Watts.

The preparation of slips, engobes, and glazes, and the study of the methods of coloring.

141-142. Ceramic Lectures. Three credit hours. The year. Ceramic Engineering, second year; Short Clayworking, first year. Mr. Harrop.

Origin of clays, constitution, properties, and winning of ceramic materials. General principles of the preparation and forming of clay wares.

143-144. Ceramic Manufacture. Three credit hours. The year. Ceramic Engineering, third year; Short Clayworking, second year. Mr. Harrop, Mr. Watts.

The drying and burning of clay wares. Glazing and decoration of clay wares.

FOR GRADUATES

201-202. Research Work.

203-204. Testing of Clays with Reference to their Industrial Adaptability.

205-206. Porcelain for Electrical and Other Special Purposes.

208. Advanced Experimental Work.

For description of graduate courses in this department see the Bulletin of the Graduate School.

CHEMISTRY

Office, 100 Chemistry Hall

PROFESSORS MCPHERSON, HENDERSON, FOULK, EVANS, AND WITHROW, ASSISTANT PROFESSORS BOORD AND OLIN, MR. HUMMELL, MR. YOUNG, MR. SWEENEY, AND DEPARTMENT ASSISTANTS

101. Elementary Chemistry. Four credit hours. First semester. One lecture, one quiz, six laboratory hours each week. Short Mining, second year; Short Clayworking, first year. Mr. Evans, Mr. Hummell.

A general introductory course on the chemistry of the non-metals. It is distinctly elementary in character and is arranged for students in short courses only. No credit is allowed for it in the regular four-year courses. Students taking this course should follow with Chemistry 102, second semester.

102. Elementary Chemistry and Qualitative Analysis. Four credit hours. Second semester. Continuation of Chemistry 101. Short Courses. Mr. Evans, Mr. Hummell.

A general introductory course on the chemistry of the metals. The laboratory work deals with the elementary principles of qualitative analysis. The course is arranged for students in short courses only. No credit is allowed for it in the regular four-year courses.

105. Elementary Chemistry. Four credit hours. Either semester. One lecture, one quiz, and six laboratory hours each week. Required of first-year students in all four-year courses who have not presented chemistry as an entrance credit. Mr. Evans, Mr. Hummell, Mr. Young, Mr. McCroskey, Mr. Coith.

A general course on the chemistry of the non-metals.

106. Elementary Chemistry and Qualitative Analysis. Four credit hours. Second semester. A continuation of Chemistry 105. Mr. Evans, Mr. Hummell, Mr. Young, Mr. McCroskey, Mr. Coith.

A general course in the chemistry of the metals. The laboratory work accompanying is a general introductory course in qualitative analysis.

109. General Chemistry. Four credit hours. Either semester. One lecture, one quiz, and six laboratory hours each week. Taken by first-year students in all four-year courses who have presented chemistry as an entrance credit. Mr. Evans, Mr. Hummell, Mr. Young, Mr. Schmidt, Mr. Adkins.

A general course on the chemistry of non-metals.

110. General Chemistry and Qualitative Analysis. Four credit hours. Second semester. A continuation of Chemistry 109. Mr. Evans, Mr. Hummell, Mr. Young, Mr. Schmidt, Mr. Adkins.

A general course in the chemistry of the metals. It is more advanced than Chemistry 106. The laboratory work is a general course in qualitative analysis.

113-114. Advanced General Chemistry. Two credit hours. The year. Two lectures each week. Chemical Engineering, second year. Prerequisite, Chemistry 106 or 110. Mr. Henderson.

A course on the fundamental topics of general chemistry designed as a thorough review and extension of the first-year courses.

117. Qualitative Analysis. Three credit hours. First semester. One lecture and six laboratory hours each week. Prerequisite, an acceptable course in general chemistry. Mr. Olin.

119. Quantitative Analysis. (a) Three credit hours. First semester. One lecture and six laboratory hours each week. Mine Engineering, second year. (b) Four credit hours. First semester. One lecture and nine laboratory hours each week. Chemical Engineering, second year. Prerequisite, Chemistry 106 or 110. It is desirable that this course be accompanied by Chemistry 113. Mr. Foulk, Mr. Olin.

The elementary principles of gravimetric and volumetric analysis.

120. Quantitative Analysis. Four credit hours. Second semester. One lecture and nine laboratory hours each week. Chemical Engineering, second year. Prerequisite, Chemistry 119. Mr. Foulk, Mr. Olin.

A continuation of Chemistry 119 with typical analytical methods in gravimetric and volumetric analysis. This course should be accompanied by Chemistry 124. It is desirable that it be accompanied by Chemistry 114.

124. Chemical Problems. One credit hour. Second semester. Chemical Engineering, second year. Mr. Foulk.

Extended practice in the solution of problems pertaining to gravimetric and volumetric analysis. This course is arranged to accompany Chemistry 120.

136. The Reading of Chemical Literature. Two credit hours. Second semester. Chemical Engineering, elective, third year. Prerequisite, one year of German. Mr. Foulk.

The object of this course is to afford practice in the rapid reading of German chemical literature, the selections being made with special reference to the technical terms of the science.

140. Thesis. Four credit hours. Second semester. Chemical Engineering, fourth year. Mr. McPherson, Mr. Henderson, Mr. Withrow, Mr. Foulk, Mr. Evans, Mr. Olin, Mr. Sweeney.

151-152. Organic Chemistry. Two credit hours. The year. Two lectures each week. Chemical Engineering, third year. Prerequisite, Chemistry 114 and 120. Mr. McPherson.

General course in organic chemistry.

153-154. Organic Chemistry. Two or three credit hours. The year. Six or nine laboratory hours each week. Chemical Engineering, third year. Must be accompanied or preceded by Chemistry 151 and 152. Mr. McPherson, Mr. Boord.

A general course in the preparation of typical organic compounds.

155. Quantitative Organic Analysis. Two credit hours. First semester. Six hours conference and laboratory work each week. Elective. Prerequisite, Chemistry 153-154. Mr. Boord.

The ultimate analysis of organic compounds and the determination of radicals.

156. Qualitative Organic Analysis. Two credit hours. Second semester. Six hours conference and laboratory work each week. Elective. Prerequisite, Chemistry 153-154. Mr. Boord.

A study of the systematic classification of organic compounds for analysis. Separation, purification and identification of organic compounds.

157-158. Physical Chemistry. Three credit hours. The year. Three lectures each week. Chemical Engineering, fourth year; Ceramic Engineering, third year. Prerequisite, Chemistry 114, 120, and 152. Mr. Henderson.

This is a general course in physical chemistry.

159. Physical Chemistry. Three credit hours. First semester. Three recitations each week. Ceramic Engineering, third year. Prerequisites, Ceramics 102 or Chemistry 120. Mr. Henderson.

A course in the practical application of physical chemistry, with emphasis upon the phase rule, the properties of solutions and colloids.

For advanced undergraduates and graduates.

161. Physical Chemistry. Two or three credit hours. Either semester. Six or nine laboratory hours each week. Elective. Prerequisite or concurrent, Chemistry 157. Mr. Henderson, Mr. Stegeman.

A laboratory course designed to illustrate the general lecture course 157-158.

165. Quantitative Analysis. Two credit hours. First semester. Two recitations each week. Prerequisite, Chemistry 119-120, or equivalent. Mr. Foulk.

Advanced course. A general survey of the methods of quantitative analysis.

167. Special Methods of Analysis. Three to five credit hours. First semester. One lecture and six to twelve laboratory hours each week. Chemical Engineering, elective, third year. Prerequisite, Chemistry 119-120.

Selections may be made from gas analysis, micro-chemical analysis and spectrum analysis. Time to be arranged.

168. Qualitative Analysis. Three to five credit hours. Second semester. One lecture, six to twelve laboratory hours each week. Chemical Engineering, elective, third year. Prerequisite, Chemistry 120, or equivalent. Mr. Olin.

Advanced course. Extended work in general qualitative analysis including the more important of the rare elements.

169. Quantitative Analysis. Three to five credit hours. First semester. One conference and six to twelve laboratory hours each week. Prerequisite, Chemistry 119-120, or equivalent. Mr. Foulk.

Advanced course. A laboratory course in advanced quantitative analysis.

176. Water Analysis. Three credit hours. Second semester. Two lectures and three laboratory hours each week. Chemical Engineering, elective, third year. Prerequisite, Chemistry 120, or equivalent. Mr. Foulk.

The methods of sanitary and industrial water analysis and interpretation of results.

177. Industrial Chemistry. Two credit hours. First semester. Two lectures each week. Prerequisite, Chemistry 113-114 and 153. Mr. Withrow.

The principles underlying the application of chemistry to the problems of the industries.

178. Industrial Chemistry. One credit hour. Second semester. One lecture each week. Prerequisite, Chemistry 177. Mr. Withrow.

182. Industrial Inspection Trip. A six-day excursion at a suitable time in connection with Chemistry 177-178 for the inspection of industrial chemical processes in actual operation. The entire expense is about $30. A satisfactory report on the work inspected is required. Mr. Withrow, Mr. Sweeney.

184. Written Reports. A course of assigned reading upon some industrial chemical process and a written report of the same. This is a substitute for Chemistry 182, but the substitution is only allowed upon presentation of reasons satisfactory to the instructor in charge. Mr. Withrow.

185. Industrial Chemistry. Two credit hours. First semester. One conference, five laboratory hours each week. Prerequisite, Chemistry 119-120. Prerequisite or concurrent, Chemistry 177. Mr. Withrow, Mr. Sweeney.

Industrial chemical research.

186. Industrial Chemistry. Three credit hours. Second semester. One conference, and eight laboratory hours each week. Prerequisite, Chemistry 119-120. Prerequisite or concurrent, Chemistry 177-178. Mr. Withrow, Mr. Sweeney.

Industrial chemical research and technical analysis.

187. Inorganic Preparations. Two or three credit hours. Either semester. Six or nine laboratory hours each week. Chemical Engineering, elective, third year. Prerequisite, Chemistry 114 and 120. Mr. Henderson, Mr. Stegeman.

The preparation of a limited number of compounds chosen so as to give practice in the different kinds of manipulation involved in the preparation of inorganic compounds.

***192. Rare Elements.** Two credit hours. Second semester. Two lectures each week. Elective. Prerequisite, Chemistry 114 and 120. Mr. Henderson.

---

*Not given in 1917-1918.

The chemistry of the rare elements, including a discussion of their increasing economic importance.

194. Applied Electro-Chemistry. Two credit hours. Second semester. Two lectures each week. Elective. Prerequisite or concurrent, Chemistry 158, except by the special permission of the instructor. Mr. Withrow.

The application of the electric current in chemical industries.

FOR GRADUATES

201-202. Physical Chemistry.

205-206. Organic Chemistry.

209-210. Inorganic Preparations.

213. Historical Chemistry.

215. Seminary in Organic Chemistry.

216. Seminary in Organic Chemistry.

217. Seminary in Organic Chemistry.

***218. Seminary in Organic Chemistry.**

***221. Seminary in Inorganic Chemistry.**

***224. Seminary in Physical Chemistry.**

225. Seminary in Advanced Industrial Chemistry.

226. Advanced Industrial Chemistry.

227. Scientific Foundations of Analytical Chemistry.

235-236. Research Work.

239. Seminary in Analytical Chemistry.

For description of graduate courses in this department see the Bulletin of the Graduate School.

CIVIL ENGINEERING

Office, 108 Brown Hall

PROFESSORS SHERMAN, ENO, AND MORRIS, ASSISTANT
PROFESSORS SCHLESINGER, SLOANE, AND KROMER,
MR. NEILSON, MR. FAEHNLE

101. Land Surveying. Four credit hours. First semester. Four recitations each week. Civil Engineering, second year. Prerequisite, Mathematics 132, Engineering Drawing 102. Mr. Sherman, Mr. Eno, Mr. Schlesinger, Mr. Sloane.

---

*Not given in 1919-1918.

Care and use of instruments. Farm, city and hydrographic surveying.

101a. Field Practice. One credit hour. First semester. Three hours each week in field. Civil Engineering, second year. Prerequisite or concurrent, Civil Engineering 101. Mr. Schlesinger, Mr. Hindman, and department instructors.

Field exercises in use of instruments and surveying.

102. Railroad Surveying. Four credit hours. Second semester. Four recitations each week. Civil Engineering, second year. Prerequisite, Civil Engineering 101 and 101a. Mr. Sherman, Mr. Schlesinger, Mr. Sloane.

Simple, compound and transition curves, frogs, switches and earthwork.

102a. Field Practice. One credit hour. Second semester. Three hours each week in field. Civil Engineering, second year. Prerequisite or concurrent, Civil Engineering 102. Mr. Schlesinger, Mr. Sloane, and department instructors.

Field practice in laying out curves, frogs, switches and earthwork.

103. Topographic Drawing. Two credit hours. First semester. Six hours each week in drafting room. Civil Engineering, second year. Prerequisite, Engineering Drawing 102. Mr. Sherman, Mr. Eno.

Exercises in black ink and color topographic drawing.

104. Summer Surveying Camp. Four credit hours. Civil Engineering, at close of second year. Prerequisite, Civil Engineering 101a and 102a.

Four weeks of six days each of ten hours a day, from the middle of June to the middle of July.

105. Topographic Surveying. Three credit hours. First semester. Nine hours each week in field or drawing room. Civil Engineering, third year. Prerequisite, Civil Engineering 101, 102, and 104. Mr. Schlesinger, Mr. Sloane.

Field and office work in four or five kinds of topographic surveying.

106. Roads and Pavements. Three credit hours. Second semester. Three recitations each week. Civil Engineering, third year. Prerequisite, Civil Engineering 102 and 104. Mr. Eno.

A study of materials and the principles of construction for rural highways and city pavements.

107. Applied Descriptive Geometry. Two credit hours. First semester. One recitation and one drawing period each week. Civil Engineering, third year. Prerequisite, Engineering Drawing 106. Mr. Schlesinger, Mr. Sloane.

Descriptive geometry and projections applied to engineering structures in timber, steel, and masonry.

108. Timber Construction. Three credit hours. Second semester. Recitations and drawing. Civil Engineering, third year. Prerequisite, Engineering Drawing 105; concurrent, Mechanics 102. Mr. Schlesinger, Mr. Sloane.

Design of timber structures, identification and properties of various trees and timbers.

109. Sanitary Engineering. Three credit hours. First semester. Three recitations each week. Civil Engineering, third year. Prerequisite, Civil Engineering 102 and 104. Mr. Eno.

A study of the principles of sewerage collection systems as applied to the design of separate and combined sewers and storm drains and the study of sewage disposal.

110. Stresses in Structures. Four credit hours. Second semester. Four recitations each week. Civil Engineering group, third year. Prerequisite or concurrent, Mechanics 102. Mr. Morris.

A course in the theory of stresses in roofs and bridges.

111. Summer Surveying Camp. Four credit hours. Civil Engineering at close of third year. Prerequisite, Civil Engineering 104 and 105.

Four weeks of six days each of ten hours a day, from the middle of June to the middle of July.

112. Railway Location. Four credit hours. Second semester. Four recitations each week. Optional with Civil Engineering 114. Civil Engineering, fourth year. Prerequisite, Civil Engineering 102 and 111 and Mechanics 102. Mr. Sherman.

A railway project used to illustrate engineering economics in construction, operation, and finance.

113. Bridge Design. Four credit hours. First semester. Four recitations each week. Civil Engineering group, fourth year. Prerequisite, Civil Engineering 110. Mr. Morris.

A course in designing and detailing roofs and bridges.

114. Advanced Bridge Design. Four credit hours. Second semester. Four recitations each week. Optional with Civil Engineering 112. Civil Engineering group, fourth year. Prerequisite, Civil Engineering 113. Mr. Morris.

The theory of stresses in and design of cantilever, swing and arch bridges.

115. Masonry Construction. Three credit hours. First semester. Three recitations each week. Civil Engineering, fourth year. Prerequisite, Civil Engineering 111, Mechanics 102. Mr. Sherman.

Review of the materials of masonry construction, and of the general subject of foundations.

116. Masonry Structures and Contracts. Three credit hours. Second semester. Three recitations, lecture, or drawing periods each week. Civil Engineering, fourth year. Prerequisite, Civil Engineering 115. Mr. Sherman.

Dams, retaining walls, piers, abutments, culverts, first two-thirds of term. Contracts and specifications, last third.

117. Water Supply. Three credit hours. Second semester. Three recitations each week. Civil Engineering, fourth year. Prerequisite, Civil Engineering 111, Mechanics 102. Mr. Eno.

A study of hydrology, sources and character of water supply, water borne diseases, construction details of water works, the purification, distribution and operation of public water supplies.

118. Cement and Concrete. Three credit hours. Second semester. Two three-hour laboratory periods each week. Ceramic Engineering, fourth year. Prerequisite, Mechanics 102 or 103. Mr. Kromer.

Recitations and laboratory work in concrete materials including the testing and mixing of them and the theory of stresses in reinforced concrete.

119. Thesis. One credit hour. First semester. Civil Engineering, fourth year. Prerequisite, Civil Engineering 110 and 111.

122. Thesis. Three credit hours. Second semester. Civil Engineering, fourth year. Prerequisite, Civil Engineering 119.

124. Trusses. Three credit hours. Either semester. Three recitations each week first three-fourths of semester, drawing room work last one-fourth of semester. Mechanical Engineering, fourth year; Architecture, Ceramic Engineering, Civil Engineering (Municipal and Sanitary Engineering group), Mine Engineering, third year. Prerequisite or concurrent, Mechanics 102 and 104. Mr. Kromer.

Stresses in and design of steel-framed buildings.

125. Tall Buildings. Three credit hours. First semester. Three lectures or recitations each week. Architectural Engineering, fourth year. Optional in Civil Engineering group, fourth year. Prerequisite, Civil Engineering 124 or concurrent, Civil Engineering 113. Mr. Morris.

Stresses in and design of steel framed office buildings.

126. Timber and Masonry. Two credit hours. Second semester. Two lectures or recitations each week. Mechanical Engineering, third year. Prerequisite, Mechanics 101. Mr. Schlesinger.

128. Plane Surveying. Two credit honrs. Second semester. One lecture and one field exercise of three hours each week. Architecture, fourth year. Mechanical Engineering, second year. Prerequisite, Engineering Drawing 102, Mathematics 132. Mr. Neilson.

129. Concrete Design. Three credit hours. Second semester. Three recitations each week. Architectural and Civil Engineering, fourth year. Prerequisite, Civil Engineering 113 or 124, Mechanical Engineering 123 or 173, and prerequisite or concurrent, Civil Engineering 118 or 130. Mr. Morris.

Design of reinforced concrete structures.

130. Cement and Concrete. Two credit hours. Either semester. Two three-hour laboratory periods each week. Architecture, Architectural and Civil Engineering, fourth year. Prerequisite, Mechanics 102 or 103. Mr. Kromer.

Recitations and laboratory work in concrete materials, including the testing and mixing of them.

138. Engineering Reports. One credit hour. Second semester. One recitation or report period each week. Civil Engineering (Municipal and Sanitary Engineering group), third year. Prerequisite, Civil Engineering 109. Mr. Eno.

Discussions and written reports upon various municipal and engineering activities and structures.

139. Municipal Engineering. Three credit hours. First semester. Three recitations each week. Civil Engineering (Municipal and Sanitary Engineering group), fourth year. Prerequisite, Civil Engineering 106. Mr. Eno.

A course covering city planning, street cleaning and maintenance, garbage and wastes disposal, and kindred subjects.

140. Sanitary and Water Supply Design. Three credit hours. Second semester. One recitation and two drawing periods each week. Civil Engineering (Municipal and Sanitary Engineering group), fourth year. Prerequisite, Civil Engineering 109 and concurrent, Civil Engineering 117. Mr. Eno.

The working of sanitary and water supply problems, assigned readings, the design of sewage collection and water distribution systems, and the design of sewage disposal and water purification plants and appurtenances.

141. Railway Maintenance. Three credit hours. First semester. Three recitations each week. Optional with Civil Engineering 125, in Civil Engineering, fourth year. Prerequisite, Civil Engineering 102 and 111. Mr. Schlesinger.

Railway maintenance problems. Design of tracks and structures. Visits of inspection.

FOR GRADUATES

201-202. Investigation and Design.

203. Railway Maintenance of Way.

204. Railway Yards and Terminals.

205. Rail and Water Transportation.

206. River Regulation and Improvement.

207. Design Work in Sewage Disposal Plants.

208. Design Work in Municipal Water Supplies.

209. Advanced Bridge Design.

210. Concrete Structural Design.

For description of graduate courses in this department see the Bulletin of the Graduate School.

ELECTRICAL ENGINEERING

Office, 171 Robinson Laboratory

PROFESSORS CALDWELL AND FLOWERS, ASSISTANT PROFESSOR KELLOGG, MR. SHEPARDSON, MR. BROWN, MR. FARMER, MR. PUCHSTEIN

101. Electrical Engineering. Five credit hours. First semester. Three lectures and four laboratory hours each week. Chemical Engineering and Mechanical Engineering, fourth year. Prerequisite, Physics 112 or Physics 114. Mr. Shepardson.

Lectures and laboratory work on direct and alternating current circuits, dynamo machinery, transformers, accumulators, and their applications.

103. Electrical Engineering. Three credit hours. Either semester. Two lectures and three laboratory hours each week. Mine Engineering, fourth year. Civil Engineering (Civil Engineering group), fourth year, alternate with Civil Engineering 125 and Civil Engineering 141; Civil Engineering (Municipal and Sanitary Engineering group), third year, alternate with Astronomy 105. Prerequisite, Physics 112 or 114. Mr. Flowers, Mr. Puchstein.

Lectures and laboratory work on direct current machinery, circuits and transmission.

104. Direct Current Machinery. Five credit hours. Second semester. Three lectures and four laboratory hours each week. Electrical Engineering, third year. Prerequisite, Physics 135, Mathematics 142, and Mechanics 101. Mr. Flowers, Mr. Shepardson.

Generators and motors, a study of their theory, construction and operation. Lectures, recitations, problems, and laboratory.

106. Applications of Electricity. One and one-half credit hours. Second semester. Three lectures each week for one-half semester. Electrical Engineering, third year. Prerequisite, Physics 135 and Mathematics 142. Mr. Caldwell.

A brief treatment of the use of electricity, in illumination, railways, mining, etc.

108. Alternating Current Circuits and Machinery. One and one-half credit hours. Three lectures each week for first half of second semester. Electrical Engineering, third year. Prerequisite, Mathematics 142, Physics 135, Mechanics 101; concurrent, Electrical Engineering 104. Mr. Caldwell.

Elementary treatment of circuits and equipment.

109. Alternating Current Machinery. Three credit hours. First semester. A continuation of Electrical Engineering 108. Three lectures each week. Electrical Engineering, fourth year. Prerequisite, Electrical Engineering 108, concurrent, Electrical Engineering 111. Mr. Caldwell.

Advanced treatment of transformers, synchronous motors, induction motors, etc.

111. Alternating Current Laboratory. Three credit hours. First semester. Electrical Engineering, fourth year. Prerequisite, Electrical Engineering 108; concurrent, Electrical Engineering 109. Mr. Brown.

Alternating current apparatus and accumulators.

112. Advanced Alternating Current Laboratory. Three credit hours. Second semester. Electrical Engineering, fourth year. Prerequisite, Electrical Engineering 109 and 111. Mr. Brown.

113. Electric Railways. Two credit hours. First semester. Electrical Engineering, fourth year. Alternative with Electrical Engineering 115, 117, and 119. Prerequisite, Electrical Engineering 104; concurrent, Electrical Engineering 109. Mr. Shepardson.

Systems, apparatus, and railway operation.

115. Telephony. Two credit hours. First semester. Electrical Engineering, fourth year. Alternative with Electrical Engineering 113, 117, and 119. Prerequisites, Electrical Engineering 104 and 108. Mr. Flowers.

Methods of telephone operation, simple circuits, apparatus and elements of transmission, theory.

117. Electric Illumination. Two credit hours. First semester Electrical Engineering, fourth year. Alternative with Electrical Engineering 113, 115, and 119. Architectural Engineering, third year. Prerequisite, Physics 112. Mr. Caldwell.

Principles of illumination, electric lamps, etc.

119. Wireless Telegraphy. Two credit hours. First semester. Electrical Engineering, fourth year. Alternative with Electrical Engineering 113, 115, and 117. Prerequisites, Electrical Engineering 104 and 108. Mr. Brown.

Elementary theory, production, transmission, and detection of damped and undamped oscillations.

121. Electrical Design. Three credit hours. First semester. Two three-hour drawing periods each week. Electrical Engineering, fourth year. Prerequisite, Electrical Engineering 104. Mr. Flowers, Mr. Puchstein.

Design of direct current dynamos, transformers, etc.

122. Electrical Design. Two credit hours. Second semester. A continuation of Electrical Engineering 121. One four-hour drawing period each week. Electrical Engineering, fourth year. Elective. Mr. Flowers.

Alternating current apparatus.

124. Electrical Transmission and Distribution. Three credit hours. Second semester. Three lectures each week. Electrical Engineering, fourth year. Prerequisite, Electrical Engineering 109. Mr. Caldwell.

Transmission and distribution systems, apparatus, and operation.

125-126. Special Reading and Laboratory. Credit hours to be arranged. The year. Elective for fourth year electrical engineering and graduate students with the consent of the instructor in charge. Prerequisites, Electrical Engineering 104 and 108.

127. Thesis. One credit hour. First semester. Electrical Engineering, fourth year. Prerequisites, Electrical Engineering 104 and 108.

128. Thesis. Five credit hours. Second semester. Electrical Engineering, fourth year.

130. Inspection Trip. March 17 to 23, 1918. Electrical Engineering, fourth year. Prerequisite, Mechanics 102.

Includes Pittsburgh, Buffalo, Niagara, and Cleveland. The entire expense need not exceed $35. A satisfactory written report on the work of the trip and an examination are required.

134. Reading Course. Electrical Engineering, fourth year. This may be taken as a substitute for Electrical Engineering 130 on presentation of reasons satisfactory to the head of the department.

Assigned reading on processes of manufacture and power plants.

131. Inspection Trip. First semester. Electrical Engineering, third year. January 30 to February 1, 1918. Visit to works of electrical and industrial interest at Columbus, Dayton and other nearby points. A written report and examination are required.

138. Advanced Laboratory. Two credit hours. Second semester. One four-hour laboratory period. Electrical Engineering, fourth year. Elective. Mr. Caldwell.

Selected tests on alternating current, apparatus, illumination, railways, etc.

FOR GRADUATES

201-202. Advanced Alternating Current Machinery.

203-204. Transient Electrical Phenomena.

205-206. Advanced Alternating Current Dynamo Laboratory.

207-208. Research Work.

For description of graduate courses in this department see the Bulletin of the Graduate School.

ENGINEERING DRAWING

Office, 204 Brown Hall

PROFESSOR FRENCH, ASSISTANT PROFESSORS MEIKLEJOHN, WILLIAMS, AND TURNBULL, MR. GILBERT, MR. SVENSEN, MR. S. S. WITHROW, MR. INAGAKY, MR. BATESOLE

101. Elementary Mechanical Drawing. Two credit hours. Either semester. All four-year courses, first year. Mr. French and department instructors.

Practice in the use of drawing instruments, elementary projections.

102. Mechanical Drawing. Three credit hours. Either semester. All four-year courses, first year. Prerequisite, Engineering Drawing 101. Lettering, orthographic, isometric, and oblique projections. Mr. French and department instructors.

103. Descriptive Geometry. Three credit hours. First semester. Two recitations, one drawing period each week. Ceramic, Chemical, Electrical, Mechanical, and Mining Engineering, second year. Prerequisite, Engineering Drawing 102 or 114. Mr. French and department instructors.

104. Machine Drawing. Three credit hours. Second semester. One lecture, two drawing periods each week. Ceramic, Chemical, Mechanical and Mine Engineering, second year. Prerequisite, Engineering Drawing 103. Mr. Williams, Mr. Gilbert, Mr. Svensen, Mr. Batesole.

105. Descriptive Geometry. Three credit hours. First semester. Two lectures, one drawing period each week. Civil Engineering, second year. Prerequisite, Engineering Drawing 102. Mr. Turnbull.

106. Advanced Descriptive Geometry. Three credit hours. Second semester. Two lectures, one drawing period each week. Civil Engineering, second year. Prerequisite, Engineering Drawing 105. Mr. Turnbull.

107. Descriptive Geometry. Three credit hours. First semester. Two recitations, one drawing period each week. Architecture, second year. Prerequisite, Engineering Drawing 102. Mr. Meiklejohn.

110. Technical Drawing. Two credit hours. Second semester. Electrical Engineering, second year. Prerequisite, Engineering Drawing 103. Mr. Williams.

111. Technical Drawing. Two credit hours. First semester. Mechanical and Electrical Engineering, third year. Prerequisite, Engineering Drawing 104 or 110. Mr. Williams, Mr. Svensen.

113. Free-hand Drawing and Lettering. Four credit hours. First semester. Short courses in Clayworking and Industrial Arts, first year; Short Mining, second year. Mr. Svensen.

114. Mechanical Drawing. Three credit hours. Second semester. Short courses in Clayworking, Industrial Arts, first year; Short Mining, second year. Prerequisite, Engineering Drawing 113. Mr. Svensen.

121-122. Technical Drawing. Two credit hours. The year. Chemical Engineering, third year. Prerequisite, Engineering Drawing 104. Mr. J. R. Withrow, Mr. Svensen.

Designing of chemical plants and machinery.

ENGLISH

Office, 103 Physics Building

PROFESSOR DENNEY, ASSISTANT PROFESSORS BECK, ANDREWS, AND PERCIVAL, MR. CRAIG, MR. DISHONG, MR. WILEY, MISS ROBINSON, MISS McCUTCHEON, MR. MOORE, MR. FOLEY, AND DEPARTMENT ASSISTANTS

110. Paragraph Writing: Description and Narration. Two credit hours. Either semester.

English 101 is given also in the Summer Session.

104. Paragraph Writing: Exposition and Argumentation. Two credit hours. Either semester. Prerequisite, English 101.

English 104 is given also in the Summer Session.

GEOLOGY

Office, 104 Orton Hall

PROFESSOR BOWNOCKER, ASSISTANT PROFESSORS HILLS AND CARMAN, MR. VERWIEBE, MISS MARK, MR. COTTINGHAM

162. Elementary Physiography. Four credit hours. Second semester. Short Mining, first year. Miss Mark.

The physiographic features of the earth's surface and the agencies producing them; the atmosphere; the ocean. Recitations, lectures, map work, and field work.

164. Elementary Geology. Three credit hours. Second semester. Short Mining, second year. Mr. Verwiebe.

Lithological, dynamical, structural, and historical geology. Recitations, lectures, and laboratory work.

165. Geology. Three credit hours. First semester. Two recitations and two laboratory hours each week. Mine Engineering, third year. Mr. Carman, Mr. Verwiebe.

During part of the semester, field trips on Saturday morning will take the place of the laboratory work.

The application of the principles of geology to mine engineering. Structural geology, dynamic geology and a briefer consideration of physiographic and historical geology.

166. Petrography. Two credit hours. Second semester. Mine Engineering, third year. Mr. Bownocker.

A study of hand specimens of igneous, metamorphic, and sedimentary rocks. Lectures and laboratory work.

167. Economic Geology. Three credit hours. First semester. Three recitations each week. Mine Engineering, fourth year. Prerequisite, Geology 165 and 166. Mr. Bownocker.

A study is made of the nature of ores, their classification and origin; the metallic ores in the United States, their distribution, abundance, modes of occurrence and origin. The coals of the Appalachian field.

168. Geology. Three credit hours. Either semester. Two recitations and two laboratory hours each week. Ceramic and Civil Engineering, third year. Mr. Carman, Mr. Verwiebe.

During part of the semester, field trips on Saturday morning will take the place of the laboratory work.

The application of the principles of geology to engineering. The study of the common rock-forming minerals and rocks, structural geology, dynamic geology and a briefer consideration of physiographic, historical and economic geology.

FOR GRADUATES

201-202. Advanced Historical Geology.

203-204. Research Work.

For description of graduate courses in this department see the Bulletin of the Graduate School.

GERMAN

Offices, 317 and 318 University Hall

PROFESSORS EVANS AND EISENLOHR, ASSISTANT PROFESSORS THOMAS, BARROWS, LEWISOHN, BUSEY AND KEIDEL, MR. KOTZ, MR. REESE, AND DEPARTMENT ASSISTANTS

101-102. Elementary German. Four credit hours. The year. Open to students in any four-year course who enter with a foreign language other than German.

The essentials of grammar and oral practice, first semester.

Reading of easy narrative, grammatical drill, second semester.

German 101 is given also during the second semester.

103. Intermediate German. Four credit hours. First semester. Prerequisite, German 102 or two units entrance credit in German. Not open to students who enter with four units entrance credit in German.

Reading of narrative prose, with topical review of grammar. One hour prose composition each week.

German 103 is given also during the second semester.

106. Science Reading. Four credit hours. Second semester. This course is for engineering students; a continuation of German 103 and 107.

Rapid reading of German technical literature. Drill on sentence structure and word formation. The object of the course is to prepare students to read technical works and current technical literature.

107. Advanced German. Four credit hours. First semester. Open to first-year students who enter with four units credit in German. By agreement with the College of Engineering, students may on securing permission, continue this course in the second semester in place of 106.

INDUSTRIAL ARTS AND SHOPWORK

Office, 125 Shop Building

PROFESSOR SANBORN, ASSOCIATE PROFESSOR W. A. KNIGHT,
MR. CASE, MR. BEEM, MR. FOUST, MR. DENMAN,
AND DEPARTMENT ASSISTANTS

INDUSTRIAL ARTS

101. Tools and Machines. Three credit hours. Second semester. Three recitations each week. Short Industrial Arts, second year. Prerequisite, Mathematics 114 or 132. Concurrent, Physics 101. Mr. Sanborn.

Principles underlying the construction and operation of machines with a special study of machine tools.

103. Designing. One credit hour. Second semester. Three laboratory hours each week. Short Industrial Arts, second year. Concurrent, Industrial Arts 101. Mr. Sanborn.

112. Machine Design. Two credit hours. Second semester. Four laboratory hours each week. Electrical Engineering, fourth year. Prerequisite, Mechanics 102 and Engineering Drawing 111. Mr. Sanborn.

Practical application of principles of machine design.

114. Shop Building. Two credit hours. Second semester. Two recitations each week. Alternative with Mechanical Engineering 146, fourth year. Prerequisite, Civil Engineering 126. Mr. Sanborn.

Lectures and problems on the construction of shop buildings and the arrangement of machinery; special shop appliances.

For courses in Shopwork see page 77.

MATHEMATICS

Office, 314 University Hall

PROFESSORS BOHANNAN, MCCOARD, SWARTZEL, KUHN, RASOR,
AND MORRIS, ASSOCIATE PROFESSOR ARNOLD, ASSISTANT
PROFESSORS PRESTON, BAREIS, AND WEST,
MISS RICKARD

101-102. Elementary Algebra. Five credit hours. The year. Short Clayworking, Short Industrial Arts, and Short Mining, first year.

113. Plane and Solid Geometry. Five credit hours. First semester. Short Clayworking, Short Industrial Arts, and Short Mining, first year.

114. Solid Geometry and Plane Trigonometry. Five credit hours. Second semester. Short Clayworking, Short Industrial Arts, and Short Mining, first year. Prerequisite, Mathematics 113.

131. College Algebra and Trigonometry. Five credit hours. Either semester. All four-year courses in Engineering, first year. Prerequisites, Entrance Algebra and Geometry.

132. Plane Trigonometry and Analytical Geometry. Five credit hours. Either semester. All four-year courses in Engineering, first year. Prerequisite, Mathematics 131.

This course is given also in the Summer Session.

141. Calculus. Five credit hours. Either semester. All four-year courses in Engineering, second year. Prerequisite, Mathematics 132.

142. Calculus. Five credit hours. Either semester. Continuation of Mathematics 141. All four-year courses in Engineering, second year. Prerequisite, Mathematics 141.

This course is given also in the Summer Session.

127-128. Calculus. Three credit hours. The year. Architecture, second year. Prerequisite, Mathematics 132.

151. Differential Equations. One credit hour. First semester. Mechanical Engineering, third year. Prerequisite, Mathematics 142.

FOR ADVANCED UNDERGRADUATES AND GRADUATES

Prerequisite: Differential and Integral Calculus.

163-164. Plane and Solid Analytical Geometry. Three credit hours. The year. Mr. Morris.

167-168. Differential Equations. Three credit hours. The year. Mr. Bohannan.

173-174. Modern Higher Algebra. Three credit hours. The year. Mr. Kuhn.

FOR GRADUATES

201-202. Theory of Functions of a Complex Variable.

203. Fourier's Series and Spherical Harmonics.

204. Vector Analysis and its Applications.

205-206. Calculus of Variations.

207. History of Mathematics.

***209-210. Theory of Statistics.**

211-212. Groups.

213-214. Differential Geometry.

215-216. Functions of a Real Variable.

217-218. Infinite Series and Products.

219-220. Theory of Numbers.

221-222. Theory of Invariants.

For description of graduate courses in this department see the Bulletin of the Graduate School.

---

*Not given in 1917-1918.

MECHANICAL ENGINEERING

Office, 244 Robinson Laboratory

PROFESSORS MAGRUDER, MARQUIS, AND SANBORN, ASSOCIATE PROFESSOR JUDD, MR. BROWN, AND DEPARTMENT ASSISTANTS

101. Mechanism. Three credit hours. First semester. Three recitations each week. Electrical Engineering, third year. Prerequisites, Engineering Drawing 103, Physics 114. Mr. Sanborn.

Recitations on the principles of mechanism and mechanical movements.

103. Steam Power Plants. Three credit hours. First semester. Three recitations each week. Mechanical Engineering, third year. Prerequisites, Engineering Drawing 104 and Physics 119; concurrent, Mechanics 101 and Metallurgy 117 and 119. Mr. Marquis.

A descriptive and analytical study of steam-generating and steam-using machinery.

104. Steam Power Plants. Four credit hours. Second semester. Four recitations each week. Mechanical Engineering, third year. Prerequisites, Mechanical Engineering 103 and Metallurgy 117 and 119; concurrent, Mechanics 102. Mr. Marquis.

A continuation of Mechanical Engineering 103.

105-106. Heat Power Engineering. Three credit hours. The year. Three recitations each week. Electrical Engineering, third year. Prerequisites, Engineering Drawing 110 and Physics 114; and concurrent, Mechanics 101 and 102. Mr. Brown.

A descriptive and analytical study of steam-generating and steam-using machinery, gas and oil engines.

107. Steam Engineering. Three credit hours. First semester. Three recitations each week. Chemical Engineering, third year. Prerequisites, Engineering Drawing 104 and Physics 112. Mr. Brown.

An elementary descriptive and analytical study of steam-generating and steam-using machinery.

110. Mechanism and Machine Design. Three credit hours. Second semester. Three recitations each week. Ceramic Engineering, third year. Prerequisites, Engineering Drawing 104, Mechanics 101. Mr. Judd.

Recitations on the principles of mechanism, mechanical movements, and elementary machine design.

114. Mechanism. Three credit hours. Second semester. Three recitations each week. Mechanical Engineering, third year. Prerequisites, Engineering Drawing 104, Physics 119. Mr. Sanborn.

Recitations and practice on the principles of mechanism and mechanical movements.

116. Mechanism Drawing. One credit hour. Second semester. One three-hour drawing period each week. Mechanical Engineering, third year. Prerequisite or concurrent, Mechanical Engineering 114. Mr. Sanborn.

Practice in laying out mechanisms and mechanical movements.

121. Heating and Ventilating. Three credit hours. First semester. Three recitations each week. Architecture and Architectural Engineering, fourth year. Prerequisite, Mechanics 103, Physics 112 or 118. Mr. Marquis.

Recitations and lectures on the principles and methods of heating and ventilation.

123. Materials of Construction. Two credit hours. First semester. One recitation and three laboratory hours each week. Architectural Engineering, third year. Concurrent, Mechanics 103. Mr. Judd.

Lectures and recitations on the materials used in architectural and building construction, and laboratory exercises on their properties.

125. Gas Engines and Producers. Two credit hours. First semester. Two recitations each week. Mechanical Engineering, fourth year. Prerequisite, Mechanical Engineering 104. Mr. Magruder.

A study of gas engines and of gas producers as used for power purposes.

127. Machine Design. Five credit hours. First semester. Five recitations each week. Chemical and Mechanical Engineering, fourth year. Prerequisites, Engineering Drawing 104 and 111, Mechanics 101, Metallurgy 117 and 119, Mechanical Engineering 103. Mr. Magruder, Mr. Sanborn.

A detailed course of study based upon mechanics and the materials of construction applied to the design and construction of machinery.

129. Thermodynamics. Two credit hours. First semester. Two recitations each week. Mechanical Engineering, fourth year. Prerequisite, Mechanical Engineering 104. Mr. Magruder.

The transmutations of heat and mechanical energies in steam and air engines, in air and ammonia compressors, and in refrigeration machines, together with a study of the tests of ideal and actual engines and of their indicator diagrams; the flow of gases through pipes and orifices.

130. Inspection Trip. March 17 to March 23, 1918. Required in Mechanical Engineering, fourth year. Prerequisite, Mechanics 102.

Includes Pittsburgh, Buffalo, Niagara Falls, Cleveland, and possibly other places. The entire expense need not exceed $35. A satisfactory written report upon the work of the trip and examination are required.

134. Reading Course. Mechanical Engineering, fourth year. Written report on assigned reading upon processes of manufacture and power plant. This may be taken as a substitute for Mechanical Engineering 130 on presentation of reasons satisfactory to the head of the department.

142. Hydraulic Machinery. Two credit hours. Second semester. Two recitations each week. Mechanical Engineering, fourth year. Prerequisites, Mechanics 102, Mechanical Engineering 104. Mr. Judd.

A study of pumping machinery.

144. Machine Design. Five credit hours. Second semester. Three recitations and two three-hour drawing periods each week. Chemical and Mechanical Engineering, fourth year. Prerequisite, Mechanical Engineering 127. Mr. Magruder and Mr. Sanborn.

A continuation of Mechanical Engineering 127, with practical applications on the drawing board of the principles to the design of some particular machine.

146. Steam Turbines. Two credit hours. Second semester. Two recitations each week. Optional in Mechanical Engineering, with Mechanical Engineering 150 and Industrial Arts 114, fourth year. Prerequisite, Mechanical Engineering 129. Mr. Marquis.

A study of the generation of power by steam turbines, including auxiliary machinery.

148. Thesis Work. Three credit hours. Second semester. Mechanical Engineering, fourth year. Prerequisites, Mechanical

Engineering 125, 127, 129, and 179. Mr. Magruder, Mr. Marquis, Mr. Judd, Mr. Brown.

A special investigation or design based upon the work of the courses.

150. Hydraulic Power. Three credit hours. Second semester. Two recitations and three laboratory hours each week. Elective in Civil and Electrical, and optional in Mechanical Engineering, fourth year. Prerequisites, Mechanical Engineering 173, 175, or 179. Mr. Judd.

A study of hydraulic turbines and the generation of hydraulic power.

160. Experimental Engineering Laboratory. Two credit hours. Second semester. Four laboratory hours each week. Electrical Engineering, third year. Concurrent, Mechanics 102 and Mechanical Engineering 106. Mr. Marquis, Mr. Judd, Mr. Brown.

Calibration of pressure gauges and indicator springs; steam engine indicator practice; testing of lubricating oils and the materials of construction.

164. Experimental Engineering Laboratory. Two credit hours. Second semester. Four laboratory hours each week. Mechanical Engineering, third year. Concurrent, Mechanics 102 and Mechanical Engineering 104. Mr. Marquis, Mr. Judd, Mr. Brown.

Calibration of pressure gauges and indicator springs; steam engine ndicator practice; testing of oils and the materials of construction.

169. Experimental Engineering Laboratory. Two credit hours. First semester. Four laboratory hours each week. Architectural Engineering, fourth year. Concurrent, Mechanical Engineering 121. Mr. Marquis.

Investigations of the heating and ventilating plants of different buildings, lay-outs, and laboratory tests of equipments used in such plants.

171. Experimental Engineering Laboratory. Three credit hours. First semester. One recitation and four laboratory hours each week. Elective in Ceramic and Chemical Engineering, fourth year. Prerequisites, Mechanics 101 and 102 or 104. Mr. Judd, Mr. Brown.

Selected laboratory exercises in the testing of lubricants and the materials of construction; calibration of pressure gauges and indicator springs; steam engine indicator practice; and brake tests of steam engines.

173. Experimental Engineering Laboratory. Five credit hours. First semester. Two recitations and six laboratory hours each week. Civil Engineering, fourth year. Prerequisite, Mechanics 102. Mr. Marquis, Mr. Judd, Mr. Brown.

Practice in the testing of the materials of construction; calibration of orifices and weirs; study of the flow of liquids and gases; tests of steam, power, rotary, and centrifugal pumps, tests of water motors and turbine water wheels. Lectures and recitations on same and on steam engines, boilers, and transmission machinery.

175. Experimental Engineering Laboratory. Three credit hours. First semester. Six laboratory hours each week. Electrical Engineering, fourth year. Prerequisites, Mechanical Engineering 106 and 160. Mr. Marquis, Mr. Judd, Mr. Brown.

Tests of steam engines and boilers, of gas and oil engines, and of steam and power pumps; hydraulic experimentation; and the use of transmission and absorption dynamometers.

179. Experimental Engineering Laboratory. Two credit hours. First semester. Four laboratory hours each week. Mechanical Engineering, fourth year. Prerequisite, Mechanical Engineering 164. Concurrent, Mechanical Engineering 125 and 129. Mr. Marquis, Mr. Judd, Mr. Brown.

Valve setting, moisture determinations in steam, gas calorimetry, measurements of flow of water by means of orifices, nozzles, weirs, and venturi-meter; tests of belts with use of transmission and absorption dynamometers.

190. Experimental Engineering Laboratory. Six credit hours. Second semester. Twelve laboratory hours each week. Mechanical Engineering, fourth year. Prerequisites, Mechanical Engineering 125, 129, and 179. Mr. Marquis, Mr. Judd, Mr. Brown.

Tests of steam and hot-air engines; steam boilers; gas and oil engines; gas producers; air compressors; injectors and pulsometers; centrifugal, rotary, and power pumps; hydraulic rams, impulse and turbine water wheels; fans and blowers, and steam turbines.

192. Experimental Engineering Laboratory. Three credit hours. Second semester. One recitation and four laboratory hours each week. Mine Engineering, fourth year. Prerequisites, Mechanics 102, Metallurgy 109. Mr. Judd, Mr. Brown.

Lectures and recitations on power transmission, steam and gas engines, steam boilers, and gas producers. Laboratory work in the calibration of pressure gauges and indicator springs; valve setting; testing of steam engines, testing of steam and centrifugal pumps; boiler and fuel trials; tests of gas engines and gas producers.

FOR GRADUATES

201-202. Research Work.

203-204. Gas Power and Design.

205-206. Gas Power Laboratory Work.

207-208. Steam Power Plant Economics and Design.

209. The Steam Locomotive.

For description of graduate courses in this department see the Bulletin of the Graduate School.

MECHANICS

Office, 219 Lord Hall

PROFESSORS BOYD AND CODDINGTON, MR. DRAFFIN

The laboratory work in strength of material, involving the use of testing machines, is given at present in the Department of Mechanical Engineering.

101. Statics and Strength of Materials. Five credit hours. First semester. Ceramic, Chemical, Civil, Electrical, Mechanical, and Mine Engineering, third year. Prerequisite, Mathematics 142.

102. Strength of Materials: Kinetics and Hydraulics. Five credit hours. Second semester. Chemical, Civil, Electrical, Mechanical, and Mine Engineering, third year. Prerequisite, Mechanics 101.

103. Statics and Strength of Materials. Five credit hours. First semester. Architecture and Architectural Engineering, third year. Prerequisite, Mathematics 128 or 142.

104. Strength of Materials. Two credit hours. Second semester. Architecture and Ceramic Engineering, third year. Prerequisite, Mechanics 101.

FOR GRADUATES

201-202. Advanced Theoretical Mechanics.

For description of graduate courses in this department see the Bulletin of the Graduate School.

METALLURGY

Office, 100 Lord Hall

PROFESSORS SOMERMEIER AND DEMOREST, MR. E. C. SMITH

102. Mineral Chemistry. Four credit hours. Second semester. Short Mining, second year. Prerequisite, Chemistry 101. Mr. Demorest, Mr. Minor.

A course of lectures upon mine gases, safety lamps, mine explosions, boiler water, mine water, water supply, explosives, coal, and coke.

105. Fire Assaying. Three credit hours. First semester. Mine Engineering, third year. Laboratory, two afternoons each week, Monday and Tuesday, or Thursday and Friday. Prerequisite, Metallurgy 106, or equivalent. Mr. McCaughey.

Lectures and laboratory work. Practical work in the assaying of gold, silver, and lead ores.

106. Metallurgical Analysis. Four credit hours. Second semester. One lecture, nine laboratory hours each week. Mine Engineering, second year. Prerequisite, Chemistry 106 or 110, Chemistry 119. Mr. Demorest.

Lectures and laboratory work. Laboratory work in the analysis of iron ores, iron and steel, fuel and slags, and ores of lead, zinc, and copper by wet methods, using approved methods as practiced in technical laboratories and metallurgical works.

107. Alloy Analysis. Four credit hours. First semester. One lecture, nine laboratory hours each week. Mine Engineering, third year. Prerequisite, Metallurgy 106. Mr. Demorest.

Lectures and laboratory work. Laboratory work in the analysis of alloy steels, such as vanadium, tungsten, chromium, nickel and molybdenum steels and other alloys. Quantitative work preceded by qualitative test on the alloys.

117. Fuel. Two credit hours. First semester. Four recitations each week during first half of first semester. Chemical, Mechanical and Mine Engineering, third year; Ceramic Engineering, fourth year. Prerequisite, Chemistry 106 or 110 and Physics 112 or 114. Mr. Somermeier.

Lectures, recitations and problems on fuels, their properties, uses, and manufacture.

119. Iron and Steel. Two credit hours. First semester. A continuation of Metallurgy 117. Four recitations each week during second half of first semester. Chemical, Mechanical and Mine Engineering, third year; Ceramic Engineering, fourth year. Mr. Demorest.

Lectures, recitations and problems on metallurgy of iron and steel.

110. Metallurgy of Non-Ferrous Metals. Four credit hours. Second semester. Mine Engineering, third year. Mr. Demorest.

Lectures and recitations on the metallurgy and properties of the non-ferrous metals; copper, lead, gold, silver, aluminum, zinc.

111. Principles of Metallurgical Construction. One credit hour. Two recitations during first half of first semester. Mine Engineering, fourth year. Prerequisites, Drawing 111, Mechanics 102, Metallurgy 109 and 113. Mr. Somermeier.

Lectures and recitations on the principles involved in the designing of furnaces and metallurgical plants.

112. Technical Gas Analysis. Two credit hours. Second semester. Mine Engineering, third year. Two afternoons each week. Prerequisite, Metallurgy 106, 109, or equivalent. Mr. Demorest.

Laboratory work supplemented by lectures. Technical analysis of metallurgical and mine gases. Determination of the calorific value of gases; problems involving application of results of gas analysis to furnace operation, mine ventilation, etc.

113. Ore Dressing and Coal Washing. Two credit hours. First semester. Mine Engineering, fourth year. Prerequisite, Metallurgy 109. Mr. McCaughey.

Methods of concentrating and enriching ores and fuels by mechanical means. Lectures with references to standard books and various papers in technical journals.

120. Metallography. Two credit hours. Second semester. Mine Engineering, fourth year. One hour lecture and three laboratory hours each week, first two-thirds of the semester. Prerequisites, Metallurgy 106, 107, 119 or equivalent. Mr. Smith.

Metallography of iron, steel and industrial alloys. Methods of examination of iron; steel; brass, bronze, bearing metals, etc. Relation of chemical composition, physical properties and micro-structure of metals.

122. Pyrometry and Calorimetry. One credit hour. Second semester. Mine Engineering, fourth year. One lecture and three laboratory hours each week, last third of the semester. Prerequisites, Metallurgy 106, 107, 119 or equivalent. Mr. Smith.

Exercises in and lectures on the uses and calibration of noble and base metal thermo-couples, optical and radiation pyrometers, bomb calorimeters for liquid and solid fuels and the Junker calorimeter for gaseous fuels.

123. Metallography. Three credit hours. First semester. Elective. One lecture and four laboratory hours each week. Prerequisites, Metallurgy 106, 107, 119 or equivalent. Mr. Smith.

The study of freezing and cooling curves, equilibrium diagrams and their meaning, changes of structure in the solid state of pure metals and alloys, such as copper, steel, brass and bronze. Microscopic examination of commercial metallurgical products and methods of metallographic research.

125. Pyrometry. One credit hour. First semester. Three laboratory hours each week. Ceramic Engineering, fourth year. Mr. Smith.

Exercises in the measurement of high temperatures by standard pyrometric methods using noble and base metal thermo-couples with galvanometer and potentiometer indicators, optical and radiation pyrometers and resistance thermometers and the calibration of pyrometers.

141. Metallurgical Investigation. Three to five credit hours. First semester. Prerequisites, one year of quantitative analysis college physics, and not less than one semester of general metallurgy. Mr. Somermeier, Mr. Demorset.

(a) **Iron, Steel and other Alloys.** Investigations on the composition, properties, structure and heat treatment. Prerequisite, Metallurgy 114.

(b) **Fuels.** Investigations on composition, conservation and utilization. Prerequisite, Metallurgy 114.

(c) **Investigations on the Metallurgy and Analysis of the Less Common Metals,** as tin, antimony, bismuth, tungsten, etc. Prerequisite, Metallurgy 109.

(d) **Investigation of Special Metallurgy Processes**, as the electrolytic refining of lead, etc. Prerequisite, Metallurgy 109.

116. Thesis. Three credit hours. Second semester.

MILITARY SCIENCE AND TACTICS

Office, The Armory

MAJOR CONVERSE, U. S. A., CAPTAIN TILFORD, U. S. A. AND LIEUTENANT SHERRARD, U. S. A.

In accordance with the Morrill Act, passed in 1862, under which the University was established, military instruction must be included in the curriculum. The Board of Trustees therefore requires all male students, both special and regular, *unless excused by the Military and Gymnasium Board*, to drill during two years. This work is under three commissioned officers of the regular army, detailed for the purpose. The Military Department offers instruction during four days each week throughout the year.

1. Military Drill. One credit hour. Five months, three hours each week, (divided between fall and spring) military drill; four months, three hours each week, (winter) of class-room instruction in drill regulations. Target practice at any open hour during the afternoon of the winter months, at 100, 200, and 300 yards. Lecture, one hour each week, by the President, upon topics of common interest to the student body.

2. Military Drill. One credit hour. Five months, three hours each week, (divided between fall and spring) in extended order and guard duty; four months, three hours each week (winter) of class-room instruction in Articles of War, guard manual, and field service regulations; target practice, at any open hour of the afternoon of the winter months, at 500, 600, and 800 yards.

MINE ENGINEERING

Office, 200 Lord Hall

PROFESSOR RAY, ASSISTANT PROFESSOR NOLD

101. Mine Engineering. Five credit hours. First semester. Lectures and field practice. Short Course in Mining, second year. Prerequisite, Mathematics 114. Mr. Nold.

This course is similar to Mine Engineering 103, but more elementary. The same text is used. The students have more practice in the drawing room.

102. Mine Engineering. Five credit hours. Second semester. Short Course in Mining, second year. Prerequisites, Mine Engineering 101, Physics 101. Mr. Nold.

Lectures illustrated by experiments, and maps of mines and models when possible; tests by safety lamps and anemometers; methods of air distribution in coal mines.

103. Mine Surveying. Four credit hours. First semester. Mine Engineering, second year; Ceramic Engineering, third year. Prerequisites, Engineering Drawing 102, Mathematics 132. Mr. Ray, Mr. Nold.

Field practice in the use of instruments for surface and underground surveys. Field notes are taken and maps and plans made in the drawing room.

104. Plans and Specifications. Four credit hours. Second semester. Mine Engineering, fourth year. Prerequisites, Mine Engineering 105, Metallurgy 111. Mr. Ray, Mr. Nold.

Practice in designing mine plants, drafting, and estimating.

105-106. Mine Engineering. Five credit hours. The year. Mine Engineering, fourth year. Prerequisites, Mechanics 102, Mine Engineering 103, Geology 165. Mr. Ray.

Lectures on mine operating, mining machinery, ventilation, shaft sinking, working out deposits, etc. Constant reference is required to standard works and to the leading technical journals.

107. Mine Engineering. Two credit hours. First semester. Four laboratory hours each week. Short Mining, second year. Concurrent, Mine Engineering 101. Mr. Nold.

109-110. Mine Trip. One credit hour. The year, Prerequisite, Mine Engineering 103, or equivalent. Mr. Nold.

111. Metallurgical Design. One credit hour. First semester. Mine Engineering, fourth year. Six laboratory hours each week during the second half of the first semester. Prerequisites, Engineering Drawing 111, Mechanics 102, Metallurgy 111, 113, 117, and 119. Mr. Nold.

Drawing room practice on the designing of furnaces and metallurgical plants.

116. Thesis. Three credit hours. Second semester. Mr. Ray, Mr. Nold.

FOR GRADUATES

201-202. Research Work.

For description of graduate courses in this department see the Bulletin of the Graduate School.

MINERALOGY

Office, 104 Lord Hall

PROFESSOR MCCAUGHEY

102. Crystallography and Mineralogy. Three credit hours. Either semester. Mine Engineering, second year; Chemical Engineering, third year; Pharmacy, fourth year. Prerequisite, Chemistry 106 or 110.

Lectures on crystallography, physical and descriptive mineralogy. Illustrated by drawings, models, and mineral specimens.

104. Determinative Mineralogy. Three credit hours. Second semester. One lecture, six laboratory hours each week. Mine Engineering, third year. Prerequisite, Mineralogy 102.

Lectures and laboratory work in practical determination of minerals by physical and chemical tests. Each student is furnished with a set of apparatus and works under an instructor's inspection. Brush and Penfield's "Determinative Mineralogy" is used as a manual.

105. Physical Chemical Mineralogy. Two credit hours. First semester. Ceramic Engineering, fourth year. Prerequisites, Chemistry 159, Ceramic Engineering 108. Mr. McCaughey.

Thermal properties of minerals, their formation and transformation in silicate mixtures.

121. Microscopic Mineralogy. Three to five credit hours. First semester. One lecture and four to eight laboratory hours each week. Prerequisites, Mineralogy 102 and Physics 114.

The use of the polarizing microscope in the identification of minerals in fine powder and in thin section. Determination of the optical constants of minerals and crystallized bodies with the polarizing microscope.

123-124. Microscopic Petrography. Five credit hours. The year. Elective. One lecture each week, four two-hour laboratory periods. Prerequisites, Mineralogy 102, Geology 165, 166. Mr. McCaughey.

Optical mineralogy. The determination and study of rock-forming minerals and rocks in hand specimen and thin section. The mineralogical and chemical composition of igneous and metamorphic rocks.

126. Advanced Crystallography and Physical Mineralogy. Three credit hours. Second semester. Two lectures and three laboratory hours each week. Prerequisites, Physics 114, Mineralogy 102.

The study of the geometrical and physical properties of crystals. Laboratory work on the measurement, calculation, and projection of crystals and the determination of the physical and optical constants of crystallized bodies.

PHYSICAL EDUCATION

Office, The Gymnasium

PROFESSORS ST. JOHN, WILCE, AND CASTLEMAN, ASSISTANT PROFESSOR NICHOLS, MR. OHLSON, MR. MARSH, MR. TRAUTMAN

101-102. Physical Education. One credit hour. The year. Two hours each week. Required of all first-year students. During the first semester the course consists of one lecture on personal hygiene and one period of active physical exercise each week.

Personal Hygiene: Lectures and quizzes on the cause, prevention, and hygienic treatment of the common preventable diseases and conditions which lower the vitality and interfere with the health and efficiency of the students.

Physical Exercise in Class: A graded course of free-hand exercises, with light hand apparatus for the relief and correction of slight bodily defects, improper carriage, etc. Progressive exercises on the apparatus and mats, to promote muscular tone, organic vigor, bodily skill, etc. Dancing, gymnastic and athletic games and contests.

PHYSICS

Office, 107 Physics Building

PROFESSORS COLE, EARHART, BLAKE, BARNETT, AND SHEARD,
ASSISTANT PROFESSOR ALPHEUS W. SMITH, MR. HEIL,
MR. WOODBURY, MR. ALVA W. SMITH, AND
DEPARTMENT ASSISTANTS

101. Elementary Physics. Six credit hours. First semester. Five recitations and lectures, and three laboratory hours each week. Short Clayworking, second year; Short Mining, first year. Textbook, Millikan and Gale's Elements of Physics. Mr. Pierce.

111. General Physics. Three credit hours. First semester. Two lectures, one recitation, and two laboratory hours each week. Architectural, Ceramic, Chemical, Civil, and Mine Engineering, second year. Prerequisite, entrance physics and Mathematics 132. All instructors.

112. General Physics. Three credit hours. Second semester. Two recitations and two laboratory hours each week. Ceramic, Chemical and Mine Engineering, second year. Prerequisite, Physics 111.

A continuation of Physics 111.

113. General Physics. Five credit hours. First semester. Electrical Engineering, three recitations and two problem periods each week; Mechanical Engineering, two recitations, two problem periods and two laboratory hours each week. Electrical and Mechanical Engineering, second year. Prerequisite, elementary physics and Mathematics 132. All instructors.

Mechanics and heat.

114. General Physics. Four credit hours. Second semester. Two recitations on general text and two on problems each week. Electrical Engineering, second year. Prerequisite, Physics 113. Mr. Heil, Mr. Smith.

117. General Physics. Two credit hours. First semester. Two recitations each week in mechanics, acoustics and heat with demonstrations. Architecture, second year. Prerequisite, entrance physics and Mathematics 132.

118. General Physics. Two credit hours. Second semester. Two recitations each week in electricity and light with demonstrations. Architecture, second year. Prerequisite, Physics 117.

119. General Physics. Three credit hours. Second semester. Three recitations each week. Mechanical Engineering, second year. Prerequisite, Physics 113. Mr. Cole, Mr. Woodbury.

125. General Physics. Five credit hours. Second semester. Three lectures and recitations on text, one hour of problem drill and one two-hour laboratory period each week. Civil Engineering, second year. Prerequisite, Physics 111. Mr. Earhart, Mr. Smith, and department assistants.

133. Physical Laboratory. Two credit hours. First semester. Four laboratory hours each week. Electrical Engineering, second year. Concurrent, Physics 113. Mr. Smith, Mr. Heil.

134. Electrical Measurements. Four credit hours. Second semester. One recitation and six hours laboratory work each week. Electrical Engineering, second year. Concurrent, Physics 114. Mr. Barnett, Mr. Ward.

135. Electrical Measurements and Photometry. Five credit hours. First semester. Nine laboratory hours each week. A continuation of Physics 134. Electrical Engineering, third year. Prerequisites, Physics 114 and 134, Mathematics 141-142. Mr. Barnett.

136. Physical Laboratory. Four credit hours. Second semester. Six laboratory hours each week, in electrical measurements; two laboratory hours each week, in mechanics and heat experiments. General Engineering, second year. Concurrent, Physics 114 and Mathematics 142. Mr. Barnett.

137. Physical Laboratory. Three to five credit hours. First semester. Prerequisite or concurrent, Physics 111. Elective.

138. Physical Laboratory. Two credit hours. Second semester. Four laboratory hours each week. Mechanical Engineering, second year. Prerequisite, Physics 111; concurrent, Physics 112. Elective, three to five credit hours. Mr. Smith, Mr. Heil.

139-140. Advanced Electrical Measurements. Three to five credit hours. The course may be elected either semester. Prerequisite, Physics 135 or equivalent. Mr. Barnett.

This course is subject to considerable variation to meet the needs of individual students, but a large amount of time is always devoted to oscillography work.

123-124. Advanced Laboratory. Three to five credit hours. The year. Prerequisite, Physics 121-122. Mr. Smith.

144. Electricity. Three credit hours. Second semester. Prerequisite, Physics 103-104 or 105-106; calculus precedes or accompanies. Mr. Earhart.

FOR GRADUATES

201-202. Research Laboratory.

***203-204. Theoretical Mechanics.**

***205-206. Thermodynamics and Electrolytic Conduction.**

207-208. Theory of Electricity and Magnetism.

***211-212. Theory of Oscillations with Applications to Wireless Telegraphy.**

***213-214. Conduction of Electricity Through Gases and Radioactivity.**

215-216. Electromagnetic Theory.

For description of graduate courses in this department see the Bulletin of the Graduate School.

ROMANCE LANGUAGES AND LITERATURES

Office, 305 University Hall

PROFESSORS BOWEN, BRUCE, AND INGRAHAM, ASSISTANT PROFESSORS HAMILTON, CHAPIN, AND PEIRCE, MR. DITCHY, MR. MOORE, MR. CARDON, MR. DE BERRIZ, AND DEPARTMENT ASSISTANTS

FRENCH

101-102. Elementary French. Four credit hours. The year. Four recitations each week. May be taken by students in any four-year course who enter with no entrance credits in French. Textbooks: Fraser and Squair's Grammar, or equivalent, and Aldrich and Foster's or Bowen's First Scientific Reader. Historical and narrative prose; one or more prose comedies.

---

*Not given in 1917-1918.

French 101 is given also during the second semester.

French 102 is given also during the first semester.

103. Modern French Literature. Four credit hours. First semester. Four recitations each week. May be taken by first-year students in any four-year course who enter with two units entrance credit in French. Prerequisite, French 101-102, or two entrance credits.

The work of the year deals with the following subjects: (1) Contes; (2) The novel (Balzac or Hugo); (3) Lyric poetry; (4) Romantic drama (Hugo). Prose composition, with practice in speaking. Systematic attention given to syntax and idiom. Lectures supplement the work. Private reading required.

French 103 is given also during the second semester.

106. Science Reading. Four credit hours. Second semester. Four recitations each week. Must be taken by students in Engineering who take French 103 during the first semester.

A course of rapid reading introductory to the vocabulary of scientific literature.

SPANISH

101-102. Elementary Spanish. Four credit hours. The year. Four recitations each week. May be taken by students in any four-year course who enter with no entrance credit in Spanish. Textbooks: Ingraham-Edgren's grammar, or equivalent, and Ingrahams' Victoria y Otros Cuentos.

Easy prose and plays. Composition and practice in speaking.

Spanish 101 is given also during the second semester.

103-104. Modern Spanish Literature. Four credit hours. The year. Four recitations each week. May be taken by students who enter with two units entrance credit in Spanish. Prerequisite, Spanish 101-102, or two units entrance credit.

The modern novel and drama. Lectures covering a survey of the literature. Composition and practice in speaking continued.

SHOPWORK

Office, 125 Shop Building

PROFESSOR SANBORN, ASSOCIATE PROFESSOR W. A. KNIGHT,
MR. CASE, MR. BEEM, MR. FOUST, MR. DENMAN,
AND DEPARTMENT ASSISTANTS

For courses in Industrial Arts see page 58.

105. Foundry Work. Two credit hours. Either semester. One recitation and four laboratory hours each week. Mechanical Engineering, second year. Second semester, Short Industrial Arts, first year. Mr. Beem, Mr. Breckur.

Exercises and practice on tempering sand and preparing molds of machine parts in sand, core-making, melting iron and brass, and pouring.

107. Chipping and Filing. Two credit hours. Either semester. One recitation and four laboratory hours each week. Mechanical Engineering, second year. Ceramic Engineering and Short Clayworking, alternative with 109 and 115, Summer Session. Second semester, Short Industrial Arts, first year. Mr. Case.

Exercises and practice in vise work including chipping in cast and wrought iron, surface filing, squaring, fitting, finishing, the scraping of surface plates, soldering and brazing.

109. Joinery and Pattern-Making. Two credit hours. Either semester. One recitation and four laboratory hours each week. First semester, Short Industrial Arts, first year. Ceramic Engineering and Short Clayworking, alternative with Shopwork 107 and 115. Chemical Engineering, Electrical Engineering, Mechanical Engineering, and Mine Engineering, during the Summer Session at the close of the first year. Mr. Beem, Mr. Denman, Mr. Smith.

Exercises and practice in joinery, wood-turning, and pattern-making, including sawing, planing, mortising, framing, and other work involving the use of the ordinary carpenter tools, center and chuck-turning, and making of finished patterns.

111. Advanced Pattern-Making. One credit hour. Either semester. Three laboratory hours each week. Mechanical Engineering, second year. Second semester, Short Industrial Arts, first year. Prerequisite, Shopwork 109. Mr. Beem, Mr. Denman, Mr. Smith.

113. Cabinet-Making. Two credit hours. Either semester. Six laboratory hours each week. Elective. Prerequisite, Shopwork 109. Mr. Beem, Mr. Denman, Mr. Smith.

Exercises and practice in cabinet-making, including paneling, mitre and dove-tail joints; use of power tools.

115. Forging. Two credit hours. Either semester. One recitation and four laboratory hours each week. Short Industrial Arts, second year. Short Mining, first year. Ceramic, Chemical, Electrical, Mechanical and Mine Engineering and Short Clayworking, during the Summer Session at the close of the first year. Mr. Foust. Mr. Wright.

The use and care of forge, fire, and tools. Practice in iron and steel forging, including such operations as cutting, bending, drawing, upsetting, shaping, and welding iron; the making, hardening, and tempering of steel punches, chisels, and lathe tools.

118. Advanced Forging. Two credit hours. Second semester. Six laboratory hours each week. Elective. Prerequisite, Shopwork 115. Mr. Foust, Mr. Wright.

Various forms of welds in iron and steel; the use of scrolling irons and of forms for duplicating work; annealing; tool-making, case-hardening; tempering drills, dies, and cutters; spring-making; ornamental iron work; visits to shops.

119. Machine Work. Three credit hours. Either semester. One recitation and six laboratory hours each week. Electrical and Mechanical Engineering and Short Industrial Arts, second year. Mr. Knight, Mr. Case.

Elementary exercises on engine lathe, such as plain, straight and taper turning, screw cutting, chuckling; boring, filing, and polishing, and the use of the drill press.

121. Advanced Machine Work. Three credit hours. Either semester. One recitation and six laboratory hours each week. Mechanical Engineering, third year; Electrical Engineering and Short Industrial Arts, second year. Prerequisite, Shopwork 119. Mr. Knight, Mr. Case.

A continuation of Shopwork 119 with more difficult exercises on the lathe, including square thread cutting, drilling, and tapping, use of steady rest, face-plate work, and bar turning. Also practice on the milling machines, planer, shaper and turret lathe.

123. Advanced Machine Work. Two credit hours. First semester. Six laboratory hours each week. Elective. Prerequisite, Shopwork 121. Mr. Knight, Mr. Case.

A more advanced course in milling machine work and grinding. Exercises in spur and spiral gear cutting, cam cutting, and differential and fractional indexing.

125. Construction Work. Two credit hours. Either semester. Six laboratory hours each week. Elective. Prerequisite, Shopwork 121. Mr. Knight, Mr. Case.

A course in construction work on any piece of apparatus or machinery which may be in course of construction in the shops.

127. Tool-Making and Jig Work. Three credit hours. Either semester. Elective. Prerequisite, Shopwork 123. Mr. Knight, Mr. Case.

130. Advanced Pattern-Making. Three credit hours. Second semester. Short Industrial Arts.

FOR GRADUATES

201-202. Research Work.

For description of graduate courses in this department see the Bulletin of the Graduate School.

SPANISH

(See Romance Languages)

FEES AND EXPENSES

All fees must be paid at the opening of each semester as a condition of admission to classes. Registration is not complete until the incidental and laboratory fees are paid.

Incidental Fee. The fee is fifteen dollars each semester.

Former students, who do not pay this fee until the third day of the first semester and second day of the second semester, must pay one dollar additional. For each day of delay thereafter, fifty cents is added.

Laboratory Deposit. Students are required to pay for all materials consumed in laboratory work. To meet the cost of these materials, a deposit for each course requiring such supplies, is made at the Bursar's office before the work is begun. In Chemistry the deposit is ten dollars. In other courses it varies with the amount of materials used. All laboratory supplies are sold at the General Store Room, Chemistry Hall, to students at about first cost to the University, and charged against the deposits. Any unused part of the deposits is refunded at the end of the semester.

Students should present their class-cards to the Bursar when they pay laboratory deposits.

OTHER EXPENSES

Locker Fee. The gymnasium is free to all students, but those desiring to use a locker are charged a fee of two dollars a semester, which includes the rental of towels.

Cadet Uniform. The uniform with which the members of the regiment are required to provide themselves costs (without overcoat) about twelve dollars. It is quiet in pattern and may be worn in place of civilian dress.

New students are advised against buying second-hand uniforms unless they have been previously inspected and approved by the Commandant. Inspection has shown in many cases that second-hand uniforms were unfit to wear and certainly not worth the price asked for them. All such uniforms are subject to rejection by the Commandant. Students should not arrange for uniforms until so directed by the military authorities.

Changes in Subjects or Schedule. Changes in subjects or schedule if made at the request of the student, shall be made only upon the payment of a fee of $1.00 for each change. The fee, in exceptional cases, may be remitted by the Executive Committee of the College.

Graduation Fee. A fee of five dollars, to cover expense of graduation and diploma, is required of each person receiving one of the ordinary degrees from the University, and this fee must be paid before the last Friday preceding Commencement. A like fee of ten dollars is charged each person receiving one of the higher graduate degrees.

The Ohio Union. A fee of one dollar a semester is paid by all male students at registration. This entitles the student to all privileges of the Union, consistent with the constitution and house rules governing it.

Text-books. Students should not purchase text-books until they are advised by the instructors of their respective classes.

EXPENSES PER YEAR

One of the most perplexing questions that confronts a prospective student is what the course is going to cost him a year.

In order to furnish information, we have listed below an estimate of the average payments required by the University for the freshman year in the College of Engineering, and have estimated the cost for room and boarding at a safe price. These two items are sometimes reduced slightly where two students occupy the same room and where boarding clubs are economically managed. Fees to the University are paid one-half at the beginning of each semester:

Incidental fees	$ 30 00
Ohio Union	2 00
Gymnasium locker	4 00
Deposits to cover laboratory materials and breakage	20 00
Drawing instruments and supplies	20 00
Uniform, gloves and shirt	15 00
Books	15 00
Board—36 weeks at $3.50 per week	126 00
Room rent, at $8.00 per month	72 00
General expenses	100 00
	$404 00

The item of general expenses is always subject to the personal habits of the individual, and varies according to the degree of economy exercised.

Note—In order to meet all the necessary expenses of registration, books, uniform, and other expenditures incident to securing a room and board, a student should come prepared to expend from $65.00 to $75.00 during the first ten days of a semester. After that period his board and room rent will constitute the major part of his expenses.

THE STILLMAN W. ROBINSON FELLOWSHIP

This fellowship endowed by Stillman W. Robinson, late Professor of Mechanical Engineering, for the encouragement of graduate research in Engineering, has a value of $500 annually and is open to graduates in Mechanical, Civil and Electrical Engineering.

The holder of this fellowship must devote his entire time to graduate work. This should lead to the Master's or the Doctor's degree under the general regulations which obtain in reference to these degrees. For further information or for application blanks address the Dean of the Graduate School or the Secretary of the College of Engineering. All applications should be filed with the Dean of the Graduate School not later than March 15th.

OFFICE HOURS OF THE SECRETARY OF THE COLLEGE

Consultation. The office hour of the Secretary of the College of Engineering is from 10 to 11 a. m. daily, Room 131, Lord Hall. Students desiring to consult the Secretary in regard to the filing of petitions, changes of courses, or of class cards, adjustment of schedules and similar needs should see him during his office hours.

The Ohio State University Bulletin is published at least twenty times during the year as follows: Monthly in June, July, August, and September, and bi-weekly in October, November, December, January, February, March, April, and May.

PRESS OHIO STATE REFORMATORY

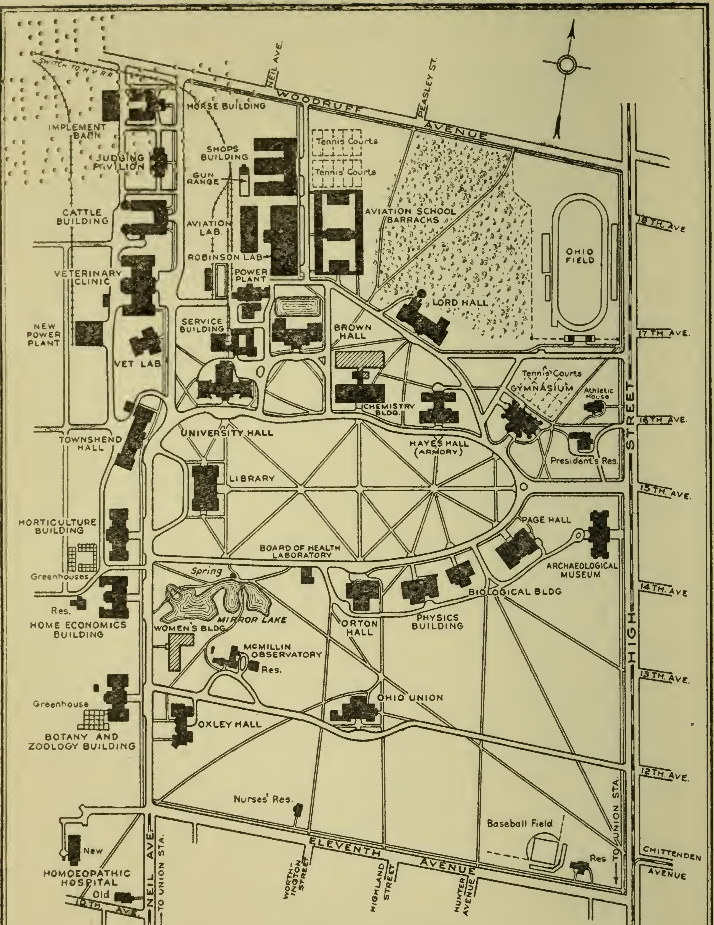
378.771
Oh Z30

The Ohio State University Bulletin
VOLUME XXII JANUARY, 1918 NUMBER 13

COLLEGE OF ENGINEERING

1918-1919

PUBLISHED BY THE UNIVERSITY AT COLUMBUS
Entered as second-class matter November 17, 1905, at the Post Office
at Columbus, Ohio, under Act of Congress, July 16, 1894



PORTION OF GROUNDS
THE OHIO STATE UNIVERSITY

Scale of Feet
100 0 100 200 300 400 500 600 700 800

1918

LEGEND

▨ Proposed buildings provided for by State Legislature.

W. D. T.

THE
JOHN CRERAR
LIBRARY

1 CE

CALENDAR 1918

JANUARY

S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

FEBRUARY

S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28		

MARCH

S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

APRIL

S	M	T	W	T	F	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

MAY

S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

JUNE

S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30						

JULY

S	M	T	W	T	F	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

AUGUST

S	M	T	W	T	F	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

SEPTEMBER

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					

OCTOBER

S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

NOVEMBER

S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

DECEMBER

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

CALENDAR 1919

JANUARY

S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

FEBRUARY

S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	

MARCH

S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

APRIL

S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

MAY

S	M	T	W	T	F	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

JUNE

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					

JULY

S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

AUGUST

S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

SEPTEMBER

S	M	T	W	T	F	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

OCTOBER

S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

NOVEMBER

S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30						

DECEMBER

S	M	T	W	T	F	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

UNIVERSITY CALENDAR

1918

Entrance examinations, Tuesday to Saturday, June 25 to 29, 8 A. M.
Summer Session, Monday, June 24 to Friday, August 16.
Entrance examinations, Tuesday to Saturday, September 10 to 14, 8 A. M.
Registration Day—First Semester—Tuesday, September 17.
President's Annual Address, Wednesday, September 18, 11 A. M.
Latest date for registration of candidates for a degree at the Commencement of June, 1919, October 1.
Registration Day, Short Courses in Agriculture—First Term—Tuesday, October 15.
Mid-semester reports to the Deans concerning delinquent students, Wednesday, November 20.
Thanksgiving recess begins November 27, 1 P. M. and ends December 3, 8 A. M.
Christmas recess begins Friday, December 20, 6 P. M.

1919

Christmas recess ends Tuesday, January 7, 8 A. M.
Registration Day, Short Courses in Agriculture—Second Term—Tuesday, January 7.
Final examinations, Wednesday, January 22 to Thursday, January 30.
First semester ends Thursday, January 30, 6 P. M.
Farmers' Week, Monday, January 27 to Friday, January 31.
Registration Day—Second Semester—Tuesday, February 4.
Washington's Birthday, Saturday, February 22.
Close of Second Term, Short Courses in Agriculture, Friday, March 21.
Mid-semester reports to the Deans, Saturday, March 22.
Easter recess, Thursday noon, April 10 to Tuesday, April 15, 8 A. M.
Memorial Day, Friday, May 30.
Competitive Drill—Cadet Regiment—Saturday, May 31.
Final examinations, Wednesday, June 4 to Thursday, June 12.
Commencement, Tuesday, June 17.
Entrance examinations, Tuesday, June 24 to Saturday, June 28, 8 A. M.
Summer Session, Monday, June 23 to Friday, August 15.

ADMINISTRATION

BOARD OF TRUSTEES

Guy W. Mallon	Cincinnati
Oscar E. Bradfute	Xenia
Frank E. Pomerene	Coshocton
Benjamin F. McCann	Dayton
John F. Cunningham	Cleveland
John Kaiser	Marietta
Charles F. Kettering	Dayton

ADMINISTRATIVE OFFICERS

President.............................William Oxley Thompson

Office: University Hall—99312; N. 476
Residence: University Grounds—2056

Secretary of the Board of Trustees and Business Manager.............................Carl E. Steeb

Office: University Hall (East End)—99332; N. 32
Residence: 1956 Iuka Ave.—5835

Registrar, University Editor and Secretary of the University Faculty.............................Edith D. Cockins

Office: 101 University Hall—99314
Residence: 1348 Neil Ave.—16310

Secretary of the Entrance Board ....Lester E. Wolfe

Office: 107 University Hall—99353; N. 939
Residence: 1491 Neil Ave.—16507

Executive Clerk.........................Katherine A. Vogel

Office: University Hall—99312; N. 476
Residence: 209 S. Monroe Ave.—E. 2356

Cashier.................................Bess C. Watters

Office: University Hall (East End)—99332; N. 32
Residence: 1851 N. Fourth St.—N. 2108

COLLEGE OF ENGINEERING

Acting Dean.............................Edwin F. Coddington

Office: 131 Lord Hall—99331
Residence: 426 Fifteenth Ave.—11920

Secretary.............................Robert Meiklejohn

Office: 131 Lord Hall—99331
Residence: 419 W. Ninth Ave.—16286

THE TEACHING STAFF

PROFESSORS

Rosser Daniel Bohannan, B. Sc., C. E., E. M..226 Sixteenth Avenue
Professor of Mathematics

Benjamin Lester Bowen, Ph. D., Litt. D.......775 East Broad Street
Professor of Romance Languages and Literatures

Joseph Villiers Denney, M. A...... ....230 West Tenth Avenue
Professor of English and Dean of the College of Arts, Philosophy and Science

*Edward Orton, Jr., E. M.... ....629 East Broad Street
Research Professor of Ceramic Engineering

William Thomas Magruder, M. E..........342 West Ninth Avenue
Professor of Mechanical Engineering

*William McPherson, M. Sc., D. Sc.,Ph. D....198 Sixteenth Avenue
Professor of Chemistry and Dean of the Graduate School

Joseph Nelson Bradford, M. E.............1778 North High Street
Professor of Architecture and University Architect

Henry Curwen Lord, B. Sc. ....University Campus
Professor of Astronomy and Director of the Emerson McMillen Observatory

Frank Edwin Sanborn, S. B. in M. E.......90 Fourteenth Avenue
Professor of Industrial Arts and Director of the Department

Frank Arnold Ray, E. M...... ....431 Citizen's Bank Building
Professor of Mine Engineering

George L. Converse, Major U. S. A...............1463 Neil Avenue
Professor of Military Science and Tactics

Francis Cary Caldwell, B. A., M. E..........206 Sixteenth Avenue
Professor of Electrical Engineering

John Adams Bownocker, D. Sc...............185 Fifteenth Avenue
Professor of Inorganic Geology and State Geologist of Ohio

Alfred Dodge Cole, M. A.........................1648 Neil Avenue
Professor of Physics

*Christopher Elias Sherman, C. E...........141 Thirteenth Avenue
Professor of Civil Engineering

---

*Absent on leave 1917-1918.

Frank Harvey Eno, B. Sc., C. E............222 Sixteenth Avenue
Professor of Municipal Engineering

James Ellsworth Boyd, M. Sc............188 East Frambes Avenue
Professor of Mechanics

Thomas Ewing French, M. E..............1458 Worthington Street
Professor of Engineering Drawing

George Washington McCoard, M. A...... ....1474 Neil Avenue
Professor of Mathematics

William Edwards Henderson, Ph. D..... ....214 Sixteenth Avenue
Professor of Inorganic and Physical Chemistry

†Charles A. Bruce, B. A...................1981 Indianola Avenue
Professor of Romance Languages

Charles William Foulk, B. A....................384 King Avenue
Professor of Analytical Chemistry

Karl Dale Swartzel, M. Sc ....1952 Iuka Avenue
Professor of Mathematics

Harry Waldo Kuhn, Ph. D.....................Grandview Heights
Professor of Mathematics

Clyde Tucker Morris, C. E. ....2043 Iuka Avenue
Professor of Structural Engineering

Edward Elsworth Somermeier, G. Ph.... ....41 King Avenue
Professor of Metallurgy

Samuel Jackson Barnett, Ph. D.............234 West Tenth Avenue
Professor of Physics

*William Lloyd Evans, M. Sc., Ph. D....81 South Champion Avenue
Professor of Chemistry

Marshall Blakemore Evans, Ph. D...... ....38 Twelfth Avenue
Professor of German

Alan Estis Flowers, M. E. in E. E., M. M. E., Ph. D..........
....1634 Neil Avenue
Professor of Electrical Engineering

Edwin F. Coddington, C. E., M. Sc., Ph. D...426 Fifteenth Avenue
Professor of Mechanics

Robert F. Earhart, Ph. D.................371 West Tenth Avenue
Professor of Physics

---

*Absent on leave 1917-1918.
†Absent on leave, second semester 1917-1918.

James Renwick Withrow, B. Sc. (Chem.), Ph. D...77 East Sixteenth Avenue
Professor of Chemistry

Berthold August Eisenlohr, M. A.............356 Twentieth Avenue
Professor of German

*Frederic Columbus Blake, Ph. D..... ....2107 Iuka Avenue
Professor of Physics

Edgar Schugert Ingraham, Ph. D ....182 East North Broadway
Professor of Romance Languages

Samuel Eugene Rasor, M. A., M. Sc...............1594 Neil Avenue
Professor of Mathematics

Charles St. John Chubb, Jr., C. E. (Arch.)...237 Seventeenth Avenue
Professor of Architecture

*Dana James Demorest, B. Sc. in Chem. Engr.................. ....372 Fourteenth Avenue
Professor of Metallurgy

Franklin Wales Marquis, B. Sc. in M. E., M. E...... ....412 West Eighth Avenue
Professor of Steam Engineering

Lynn Wilbur St. John, B. Ph...................168 Twelfth Avenue
Professor of Physical Education

John Woodworth Wilce, B. A...................70 Twelfth Avenue
Professor of Physical Education

Frank Riley Castleman, B. Sc.............161 East Frambes Avenue
Professor of Physical Education

Arthur S. Watts..............................1764 North High Street
Professor of Ceramic Engineering

Charles C. Morris, M. A......................207 Thirteenth Avenue
Professor of Mathematics

Charles Fabens Kelley, B. A ....1951 Summit Street
Professor of Art

William John McCaughey, B. Sc. (Chem.), Ph. D.............. ....108 East Frambes Avenue
Professor of Mineralogy

Alpheus Wilson Smith, M. A., Ph. D..........306 Sixteenth Avenue
Professor of Physics

---

*Absent on leave 1917-1918.

J. Ernest Carman, Ph. D........................17 Twelfth Avenue
Professor of Geology

*John Herbert Nichols, B. A., M. D......113 East Norwich Avenue
Professor of Physical Education

Carl A. Norman, M. E. ....1990 Summit Street
Professor of Machine Design

Howard D. Smith, C. E. in Arch., B. Arch......256 Twelfth Avenue
Professor of Architecture

ASSOCIATE PROFESSORS

Charles Lincoln Arnold, M. Sc..............328 West Eight Avenue
Associate Professor of Mathematics

William Abner Knight, M. E.................206 West Lane Avenue
Associate Professor of Machine Shop Practice

Horace Judd, M. E., M. Sc..................281 Thirteenth Avenue
Associate Professor of Experimental Engineering

*Edmund Sewall Manson, Jr., M. Sc.............................
Associate Professor of Astronomy

ASSISTANT PROFESSORS

John Bowker Preston, M. A ....290 Fifteenth Avenue
Assistant Professor of Mathematics

Robert Meiklejohn, M. E . ... .419 West Ninth Avenue
Assistant Professor of Engineering Drawing

May Thomas, Ph. D....................233 West Eleventh Avenue
Assistant Professor of German

Grace Bareis, Ph. D....................201 West Eleventh Avenue
Assistant Professor of Mathematics

Theodore Ely Hamilton, M. A., Ph. D.............319 King Avenue
Assistant Professor of Romance Languages

Sarah Tracy Barrows, M. L..................1806 North High Street
Assistant Professor of German

Edwin Long Beck, M. A.........................2651 Summit Street
Assistant Professor of English

Thomas McDougal Hills, B. Ph.................. 1942 Iuka Avenue
Assistant Professor of Geology

---

*Absent on leave 1917-1918.

*Ludwig Lewisohn, M. A., Litt. D............................
Assistant Professor of German

Robert Oscar Busey, M. A.......................2090 Iuka Avenue
Assistant Professor of German

George S. Chapin, M. A...................321 Seventeenth Avenue
Assistant Professor of Romance Languages

Carl B. Harrop, E. M......................2326 Indianola Avenue
Assistant Professor of Ceramic Engineering

Cecil E. Boord, M. A., Ph. D.................417 Thirteenth Avenue
Assistant Professor of Chemistry

*Walter Pierce, M. A., Ph. D...................................
Assistant Professor of Romance Languages

George F. Schlesinger, C. E..................227 Fifteenth Avenue
Assistant Professor of Civil Engineering

Owen E. Williams.............................2094 Tuller Street
Assistant Professor of Engineering Drawing

*Clarence E. Andrews, Ph. D.....................................
Assistant Professor of English

Milton Percival, Ph. D.....................289 Eighteenth Avenue
Assistant Professor of English

Roscoe C. Sloane, B. Ph., C. E..................7 Twelfth Avenue
Assistant Professor of Civil Engineering

William D. Turnbull, C. E...............151 East Oakland Avenue
Assistant Professor of Engineering Drawing

Hubert L. Olin, Ph. D.........................302 Clinton Street
Assistant Professor of Chemistry

Harry E. Nold, E. M....................215 West Eleventh Avenue
Assistant Professor of Mine Engineering

Carl L. Svensen, B. Sc.....................1320 North High Street
Assistant Professor of Engineering Drawing

Herman G. Heil, Ph. D.....................323 West Ninth Avenue
Assistant Professor of Physics

Hewitt Wilson, Cer. E........................586 Oakwood Avenue
Assistant Professor of Ceramic Engineering

William M. Tucker, Ph. D......................33 Alhambra Court
Assistant Professor of Geology

---

*Absent on leave 1917-1918.

INSTRUCTORS

Frank H. Haskett.................................380 King Avenue
Instructor in Architecture

Wilbert C. Ronan, C. E. (Arch.), B. Sc.(Arch.)..47 Twelfth Avenue
Instructor in Architecture

William J. Norris..........................60 East Eighth Avenue
Instructor in Art

James H. Young, M. Sc..... .... 2080 Peasley Street
Instructor in Chemistry

Jesse Erwin Day, Ph. D......................... 2428 Summit Street
Instructor in Chemistry

Homer Burton Adkins, M. A..............140 East Norwich Avenue
Instructor in Chemistry

Herbert Spencer Coith, M. Sc...................20 University Place
Instructor in Chemistry

Wilhelm Neilson, B. Sc. in C. E............ 3028 North High Street
Instructor in Civil Engineering

Carl G. Faehnle, C. E............................385 Buttles Avenue
Instructor in Civil Engineering

Grover C. Seegar, B. C. E.................... .....128 King Avenue
Instructor in Civil Engineering

Jacob Ralph Shank, B. Sc..................97 West Tompkins Street
Instructor in Civil Engineering

John E. Shepardson, B. Sc..... .... Granville, Ohio
Instructor in Electrical Engineering

Roy A. Brown, M. E. in E. E...................2074 Peasley Street
Instructor in Electrical Engineering

J. Forest Craig, M. A.......................... 1273 Summit Street
Instructor in English

Charles G. Dishong, B. Sc. (Edu.), M. A.....75 West Tenth Avenue
Instructor in English

Earl W. Wiley, M. A..............................438 King Avenue
Instructor in English

Gertrude L. Robinson, M. A.....................Worthington, Ohio
Instructor in English

Louis Foley, M. A...............................16 Alhambra Court
Instructor in English

Verona Mae Dollinger, M. A. .... 1954 Indianola Avenue
Instructor in English

*Theodore F. Kotz, M. A. ....
Instructor in German

Allando A. Case .... 347 West Tenth Avenue
Instructor in Industrial Arts

Clement M. Beem .... 51 West Frambes Avenue
Instructor in Industrial Arts

Jacob A. Foust .... 21 West Frambes Avenue
Instructor in Industrial Arts

Ulysses W. Denman .... 505 Chilcote Avenue
Instructor in Industrial Arts

John J. Breckur .... 1133 Highland Street
Instructor in Industrial Arts

Hortense Rickard, M. A. .... 333 West Tenth Avenue
Instructor in Mathematics

James Henry Weaver, Ph. D. .... Hilliards, Ohio
Instructor in Mathematics

John T. Lomax May, B. Sc. .... 1968 Indianola Avenue
Instructor in Mechanical Engineering

Jasper O. Draffin, B. Sc. in C. E., M. Sc. ..... 315 West Ninth Avenue
Instructor in Mechanics

*Earl C. Smith, E. M. ....
Instructor in Metallurgy

Henry C. Ohlson .... 18 Seventeenth Avenue
Instructor in Physical Education

*George M. Trautman, B. Sc. (Forestry) ....
Instructor in Physical Education

Dwight A. Woodbury, M. Sc. .... 308 Nineteenth Avenue
Instructor in Physics

Alva W. Smith, M. A. .... 1152 Grandview Avenue
Instructor in Physics

Raymond Clyde Ditto, M. A. .... 1430 Worthington Street
Instructor in Physics

Leopold Cardon, B. ès L. .... 312 Clinton Avenue
Instructor in Romance Languages

---

*Absent on leave 1917-1918.

Stephen C. Guigou, B. A.................. ...1981 Indianola Avenue
Instructor in Romance Languages

Santiago Gutierrez, M.A ....228 West Lane Avenue
Instructor in Romance Languages

John Bradley Riley, B.A......................15 Fourteenth Avenue
Instructor in Romance Languages

Worcester B. Field, C. E. in Arch..... ....22 East Lane Avenue
Instructor in Engineering Drawing

Ernest S. Berthemy...........................211 East State Street
Instructor in Romance Languages

Ossian C. Bird, B. A. ....2049 Waldeck Avenue
Instructor in Physical Education

H. Halouk Fikret, B. S. in M. E., A.R.C........98 Twelfth Avenue
Instructor in Mechanical Engineering

Henri Tailliart, B. A.................... ......36 Fifteenth Avenue
Instructor in Romance Languages

ASSISTANTS

Clarence Ames Mathias, B. Arch...........1848 North Fourth Street
Assistant in Architecture

Marion Hollingsworth, M. A......... .... 1562 Worthington Street
Assistant in Chemistry

Clyde Stewart Adams, B.Sc.................138 West Ninth Avenue
Assistant in Chemistry

Julia Edith Whitten, B.A....... ....
Assistant in Chemistry

William Wert Bauer, B.A..................160 West Ninth Avenue
Assistant in Chemistry

Frank Carl Vilbrandt, M.A..................134 West Lane Avenue
Assistant in Chemistry

Parker Karns Baird, B. A.......................23 Fifteenth Avenue
Assistant in Chemistry

Carl Emmit Frick, B. Sc.......................23 Fifteenth Avenue
Assistant in Chemistry

Melvin Guy Mellon, M. Sc................189 West Eleventh Avenue
Assistant in Chemistry

Carleton Edgar Curran, M. A..................91 Sixteenth Avenue
Assistant in Chemistry

Aubrey Hess.... ....166 West Lane Avenue
Assistant in Chemistry

Albert F. Puchstein, B. E. E................166 West Tenth Avenue
Assistant in Electrical Engineering

Troi O. Farmer, M. E. in E. E............27 East Patterson Avenue
Assistant in Electrical Engineering

Samuel S. Withrow..... ....417 Eighteenth Avenue
Assistant in Engineering Drawing

Byron Marshal Warder.......................8 Chittenden Avenue
Assistant in Engineering Drawing

Floyd Marion Martin..........................281 Dakota Avenue
Assistant in Engineering Drawing

Perry L. Wright.............................139 West Lane Avenue
Assistant in Industrial Arts

Harold Wright...............................963 Sullivant Avenue
Assistant in Industrial Arts

Carl M. Senn...................... .....1551 Worthington Street
Assistant in Industrial Arts

Thomas C. Coleman, B. Sc ....
Assistant in Industrial Arts

Charlotte Morningstar, M. A..................1275 Franklin Avenue
Assistant in Mathematics

Charles W. Jarvis, B. Sc., B. A..........158 East Northwood Avenue
Assistant in Physics

I. Garnett Barber, B. A......................45 West Tenth Avenue
Assistant in Physics

John S. Ward, B. Sc.. ....1618 Hunter Avenue
Assistant in Physics

Robert Carl Schott, B. E. E.......................1136 Neil Avenue
Assistant in Electrical Engineering

Joseph S. Gregorius.................. ... 319 West Ninth Avenue
Assistant in Metallurgy

THE OHIO STATE UNIVERSITY

The Ohio State University, located in Columbus, is a part of the public educational facilities maintained by the State.

ORGANIZATION

For convenience of administration, the departments of the University are grouped into organizations called colleges. The Ohio State University comprises eleven colleges and a graduate school, each under the administration of a Dean and College Faculty, as follows:

Graduate School
College of Agriculture
College of Arts, Philosophy and Science
College of Commerce and Journalism
College of Dentistry
College of Education
College of Engineering
College of Homœopathic Medicine
College of Law
College of Medicine
College of Pharmacy
College of Veterinary Medicine

SUMMER SESSION

In addition to the above, there is a Summer Session under the supervision of a Director and governing committee for the administration of the regular University courses offered in the summer.

This bulletin of announcements is devoted exclusively to the work of the College of Engineering, offered during the academic year beginning September, 1918.

(*Note*—The University publishes a bulletin descriptive of each college. Copies may be obtained by addressing L. E. Wolfe, Secretary of the Entrance Board, Ohio State University, Columbus, Ohio, and stating the college in which the writer is interested.)

THE COLLEGE OF ENGINEERING

The purpose of the College of Engineering is to instruct students in the fundamental sciences and arts, upon which all engineering rests, and to impart such special and technical knowledge of the various branches of engineering as will enable its graduates to enter them and maintain themselves while gaining their professional experience. To accomplish this purpose, the work of the College is classified under nine curricula, which are described on the following pages and which lead to the following degrees:

Bachelor of Architecture (B. Arch.)
Bachelor of Architectural Engineering (B. Arch. E.)
Bachelor of Ceramic Engineering (B. Cer. E.)
Bachelor of Chemical Engineering (B. Ch. E.)
Bachelor of Civil Engineering (B. C. E.)
Bachelor of Electrical Engineering (B. E. E.)
Bachelor of Mechanical Engineering (B. M. E.)
Bachelor of Engineering in Mining (B. E. M.)
Bachelor of Engineering (B. E.)

The curriculum leading to the degree of B. E. is offered for the benefit of those students who may desire instruction not included in any one of the special curricula, and also for those who may wish an opportunity to pursue a limited number of cultural studies, together with elective engineering studies. It is believed, however, that the severe mental discipline of any of these curricula makes the work of the College of Engineering the equal of any other in general educational value.

FIVE-YEAR CURRICULUM

For the benefit of those who are unable to carry the full schedule, on account of outside work for self-support, impaired health, or any other valid reason, any of the regular curricula can be rearranged to cover five instead of four years.

COMBINATION CURRICULA

It is also possible to arrange combination curricula leading to two degrees in five or more years. (See page 33)

GRADUATE COURSES

Advanced courses in various engineering subjects are offered by the departments of the College of Engineering, to those who wish to pursue them. If such courses are pursued with the expectation of receiving credit upon them to apply towards any higher degree, the student must register in the Graduate School, under whose jurisdiction all work for the higher degrees is conducted. For further information, consult the Bulletin of the Graduate School of the University or confer with the Dean or Secretary. (See page 34.)

SPECIAL STUDENT'S CERTIFICATE

A special certificate will be issued to any special student, completing a special course of not less than 60 credit hours, approved by the Dean and the head of the department in which the major portion of the student's work lies. The certificate will contain a statement of the subjects taken.

GENERAL INFORMATION

OFFICE HOURS OF THE SECRETARY OF THE COLLEGE

The office of the College of Engineering is in Room 131, Lord Hall. The office hours are 8 to 12 a. m. and 1:30 to 5 p. m. daily, except Saturday. Office hours Saturday, 8 to 12 m.

RESERVE OFFICERS TRAINING CORPS

Under the Defense Act of June 3rd, 1916, there was established at the Ohio State University a Reserve Officers Training Corps to which all students are eligible who have completed the requirements in Military Drill for the first and second years. Students entering the Reserve Officers Training Corps are required to complete a practical and theoretical course in Military Science extending through the Junior and Senior years of residence. When this requirement is completed the President of the United States will grant them a commission as 2nd Lieutenant in the Officers Reserve Corps when recommended by the Commandant of Cadets and the President of the University.

During this two years of required work the United States will furnish to the student one complete uniform each year and one ration which is commuted at 30 cents per day during the fiscal year. (See page 32.)

THESIS

As a requisite for graduation each candidate in the College of Engineering must present an acceptable thesis, embodying the results of a special study. The subject of this study must lie within the field of the degree sought. The subject must be filed with the head of the department, under whose direction the work is done, on the official blank provided for the purpose, not later than December 15th, of the University year in which the degree is sought. The completed thesis must be submitted to the professor who has directed the work not later than the second Thursday before Commencement Day for final approval.

If the thesis is then approved the student shall deposit two copies of it with the University Editor not later than noon of the Thursday before Commencement, and shall pay to the Editor a fee covering the cost of binding the same.

THE STILLMAN W. ROBINSON FELLOWSHIP

This fellowship endowed by Stillman W. Robinson, late Professor of Mechanical Engineering, for the encouragement of graduate research in Engineering, has a value of $500 annually and is open to graduates in Mechanical, Civil and Electrical Engineering.

The holder of this fellowship must devote his entire time to graduate work. This should lead to the Master's or the Doctor's degree under the general regulations which obtain in reference to these degrees. For further information or for application blanks address the Dean of the Graduate School or the Secretary of the College of Engineering. All applications should be filed with the Dean of the Graduate School not later than March 15th.

FEES AND EXPENSES

All fees must be paid at the opening of each semester as a condition of admission to classes. Registration is not complete until the incidental and laboratory fees are paid.

Incidental Fee. The fee is fifteen dollars each semester.

Former students, who do not pay this fee until the third day of the first semester and second day of the second semester, must pay one dollar additional. For each day of delay thereafter, fifty cents is added.

Laboratory Deposit. Students are required to pay for all materials consumed in laboratory work. To meet the cost of these materials, a deposit for each course requiring such supplies, is made at the Bursar's office before the work is begun. In Chemistry the deposit is ten dollars. In other courses it varies with the amount of materials used. All laboratory supplies are sold at the General Store Room, Chemistry Hall, to students at about first cost to the University, and charged against the deposits. Any unused part of the deposits is refunded at the end of the semester.

Students should present their class-cards to the Bursar when they pay laboratory deposits.

OTHER EXPENSES

Locker Fee. The gymnasium is free to all students, but those desiring to use a locker are charged a fee of two dollars a semester, which includes the rental of towels.

Cadet Uniform. The uniform with which the members of the regiment are required to provide themselves costs (without overcoat) about twelve dollars. It is quiet in pattern and may be worn in place of civilian dress.

New students are advised against buying second-hand uniforms unless they have been previously inspected and approved by the Commandant. Inspection has shown in many cases that second-hand uniforms were unfit to wear and certainly not worth the price asked for them. All such uniforms are subject to rejection by the Commandant. Students should not arrange for uniforms until so directed by the military authorities.

Changes in Subjects or Schedule. Changes in subjects or schedule if made at the request of the student, shall be made only upon the payment of a fee of $1.00 for each change. The fee, in exceptional cases, may be remitted by the Executive Committee of the College.

Graduation Fee. A fee of five dollars, to cover expense of graduation and diploma, is required of each person receiving one of the ordinary degrees from the University, and this fee must be paid before the last Thursday preceding Commencement. A like fee of ten dollars is charged each person receiving one of the higher graduate degrees.

The Ohio Union. A fee of one dollar a semester is paid by all male students at registration. This entitles the student to all privileges of the Union, consistent with the constitution and house rules governing it.

Text-books. Students should not purchase text-books until they are advised by the instructors of their respective classes.

EXPENSES PER YEAR

One of the most perplexing questions that confronts a prospective student is what the course is going to cost him a year.

In order to furnish information, we have listed below an estimate of the average payments required by the University for the freshman year in the College of Engineering, and have estimated the cost for room and boarding at a safe price. These two items are sometimes reduced slightly where two students occupy the same room and where boarding clubs are economically managed. Fees to the University are paid one-half at the beginning of each semester:

Incidental fee..	$ 30 00
Ohio Union	2 00
Gymnasium locker	4 00
Deposits to cover laboratory materials and breakage.	20 00
Drawing instruments and supplies	20 00
Uniform, gloves and shirt	15 00
Books	15 00
Board—36 weeks at $3.50 per week	126 00
Room rent, at $8.00 per month	72 00
General expenses	100 00
	$404 00

The item of general expenses is always subject to the personal habits of the individual, and varies according to the degree of economy exercised.

Note—In order to meet all the necessary expenses of registration, books, uniform, and other expenditures incident to securing a room and board, a student should come prepared to expend from $65.00 to $75.00 during the first ten days of a semester. After that period his board and room rent will constitute the major part of his expenses.

ADMISSION

The college is open on equal terms to both sexes. Applicants for admission must be at least seventeen years of age.

THE ENTRANCE BOARD

The admission of students to the University is in charge of the Entrance Board, which determines the credit that shall be issued on all entrance examinations and certificates, and furnishes all desired information to applicants. Correspondence relating to admission should be addressed to the Secretary of the Entrance Board, Ohio State University, Columbus, Ohio.

REQUIREMENTS

To obtain full standing in the College of Engineering, an applicant under twenty-one years of age must be a graduate of a high school of the first grade and must receive credit by certificate or by examination for fifteen units.

Of these fifteen units, not less than three shall be in English; three in mathematics (including solid geometry); one in physics; four in languages (other than English); and four shall be elective, and may include any subject given by any first-grade high school.

In case of a limited number of schools in which manual training is especially recommended, two units of foreign language may be replaced by two units of manual training or mechanical drawing. At present these schools are as follows: East Technical High School, Cleveland; West Technical High School, Cleveland; Stivers Manual Training High School, Dayton; Woodward High School, Cincinnati; Central High School, Toledo; Portsmouth High School.

Applicants under twenty-one years of age may be admitted to the college with a deficiency of two units in foreign language and one unit in other topics.

An applicant over twenty-one years of age may be admitted with a total deficiency of four units. Of these four units, all may be in foreign language, but not more than two units may be in subjects other than foreign language.

For admission by examination see page 27, by certificate see page 28 of the *Bulletin of General Information.*

GENERAL REQUIREMENTS FOR ADMISSION AS A SPECIAL STUDENT

An applicant who desires to pursue a special plan of work in the University, but who is not a candidate for a degree will be admitted as a special student upon the following conditions.

(a) He must satisfy the regular entrance requirements of the College of Engineering.

(b) He must submit to the Executive Committee of the college for approval a written statement of the end he has in view, the studies proposed for the attainment of that end, and the probable period of his residence at the University. He will be held as rigidly to his accepted scheme of work as are regular students to their prescribed course of study.

REQUIREMENTS FOR A SPECIAL STUDENT OVER TWENTY-ONE YEARS OF AGE

An applicant who is over twenty-one years of age and who is unable to meet the entrance requirements may be admitted as a special student by the Entrance Board provided he has first secured the approval of his proposed course of study by the Executive Committee of the college. But students who are admitted as special students cannot become candidates for a degree until they have satisfied all entrance requirements.

CURRICULA

OUTLINE OF THE FIRST YEAR'S WORK OF ALL FOUR-YEAR CURRICULA

In order to permit all engineering students to have a year in which to find out definitely what courses they desire to pursue, the first year of all engineering curricula except Architecture, is made uniform. While students are asked to indicate their choice on entering the College, they can change at the end of the first year without any inconvenience.

Note—The figure in parenthesis following the name of each study indicates the number of the study in its department, the other figure indicates the number of credit hours.

First Semester			Second Semester		
Mathematics College Algebra and Trigonometry	(131)	5	Mathematics Trigonometry and Analytics	(132)	5
Chemistry General Chemistry	(105 or 109)*	4	Chemistry General Chemistry and Qualitative Analysis	(106 or 110)*	4
Modern Language French, German or Spanish		4	Modern Language French, German or Spanish		4
English Paragraph Writing	(101)	2	English Paragraph Writing	(104)	2
Engineering Drawing Elementary Mechanical	(101)	2	Engineering Drawing Lettering and Projections	(102)	3
Physical Education		1	Physical Education		1
Military Drill		1	Military Drill		1

SUMMER SESSION

Shopwork is required in the Summer Session in all Engineering curricula except Architecture and Civil Engineering. In Electrical, Mechanical, and Mine Engineering, the shopwork courses (109) and (115) are required at the end of the first year. In Chemical Engineering, the same courses are required, but may be taken at the end of the first or second year. In Ceramic Engineering and in General Engineering, Shopwork (107), (109), and (115) are offered and two of these must be taken at the end of the first year.

---

*Students presenting Chemistry as an entrance subject will take Chemistry 109 and 110. Students with no entrance credits in Chemistry will take Chemistry 105 and 106.

ARCHITECTURE

FIRST YEAR

FIRST SEMESTER			SECOND SEMESTER		
Mathematics College Algebra and Trigonometry	(131)	5	Mathematics Trigonometry and Analytics	(132)	5
French	(101 or 103)	4	French	(102 or 106)	4
English Paragraph Writing	(101)	2	English Paragraph Writing	(104)	2
Engineering Drawing Elementary Mechanical	(101)	2	Engineering Drawing Lettering and Projections	(102)	3
Art Elementary Drawing	(131)	2	Art Elementary Drawing	(132)	2
Architecture Elements of Architecture	(131)	2	Architecture Elements of Architecture	(132)	2
Physical Education		1	Physical Education		1
Military Drill		1	Military Drill		1

SECOND YEAR

Mathematics Calculus	(127)	3	Mathematics Calculus	(128)	3
Physics General Physics	(117)	2	Physics General Physics	(118)	2
Engineering Drawing Descriptive Geometry	(107)	3	Architecture Shades, Shadows and Perspective	(124)	3
Art Advanced Drawing	(133)	2	Art Elementary Design	(141)	2
Architecture History of Architecture	(133)	3	Architecture History of Architecture	(134)	3
Architecture Design	(141)	5	Architecture Design	(142)	5
Military Drill		1	Military Drill		1

SUMMER COURSE—Architecture (121), Architectural Practice, or an Architectural Problem. Four credit hours.

THIRD YEAR

Mechanics Statics and Strength of Materials	(103)	5	Civil Engineering Trusses	(124)	3
Art Water Color	(161)	2	Art Advanced Water Color	(162)	2
Architecture Architectural Composition	(113)	2	Architecture Wood Construction	(150)	5
Architecture Photography	(111)	2	Architecture History of Architecture	(136)	3
Architecture History of Architecture	(135)	2	Architecture Design	(144)	5
Architecture Design	(143)	5			

SUMMER COURSE—Architecture (121), Architectural Practice, or an Architectural Problem. Four credit hours.

FOURTH YEAR

FIRST SEMESTER			SECOND SEMESTER		
Mechanical Engineering Heating and Ventilating	(121)	3	Civil Engineering Cement and Concrete	(130)	2
Architecture Plumbing	(117)	1	Architecture Professional Practice	(116)	4
Architecture Masonry	(151)	3	Architecture Thesis	(118)	5
Architecture Ornament	(147)	4	Architecture Design	(146)	5
Architecture Design	(145)	5	Art Drawing from Life	(164)	2
Art Drawing from Life	(163)	2			

For thesis requirements see page 15.

ARCHITECTURAL ENGINEERING

FOR FIRST YEAR, SEE PAGE 21

SECOND YEAR

Mathematics Calculus	(141)	5	Mathematics Calculus	(142)	5
Physics General Physics	(111)	3	Physics General Physics	(112)	3
Engineering Drawing Descriptive Geometry	(107)	3	Architecture Shades, Shadows and Perspective	(124)	3
Architecture Elements of Architecture	(131)	2	Architecture Elements of Architecture	(132)	2
Architecture History of Architecture	(133)	3	Architecture History of Architecture	(134)	3
Art Elementary Drawing	(131)	2	Art Elementary Drawing	(132)	2
Military Drill		1	Military Drill		1

SUMMER COURSE—Architecture (120), Architectural Practice, or an Architectural Problem. Four credit hours.

THIRD YEAR

Mechanics Statics and Strength of Materials	(103)	5	Mechanics Strength of Materials	(104)	2
Mechanical Engineering Materials of Construction	(123)	2	Civil Engineering Trusses	(124)	3
Architecture Architectural Composition	(113)	2	Architecture Photography	(111)	2
Architecture History of Architecture	(135)	2	Architecture Wood Construction	(150)	5
Architecture Design	(141)	5	Architecture Design	(142)	5
Electrical Engineering Illumination	(117)	2			

SUMMER COURSE—Architecture (121), Architectural Practice, or an Architectural Problem. Four credit hours.

FOURTH YEAR

FIRST SEMESTER			SECOND SEMESTER		
Mechanical Engineering Heating and Ventilating	(121)	3	Civil Engineering Cement and Concrete	(130)	2
Mechanical Engineering Experimental Engineering Laboratory	(169)	2	Civil Engineering Surveying	(128)	2
Architecture Plumbing	(153)	2	Architecture Professional Practice	(116)	4
Architecture Masonry	(151)	3	Architecture Thesis	(118)	5
Architecture Design	(143)	5	Architecture Fire Protection	(123)	2
Civil Engineering Tall Buildings	(125)	3	Civil Engineering Concrete Design	(129)	3

For thesis requirements see page 15.

CERAMIC ENGINEERING

FOR FIRST YEAR, SEE PAGE 21

SECOND YEAR

Mathematics Calculus	(141)	5	Mathematics Calculus	(142)	5
Physics Mechanics and Heat	(111)	3	Physics Electricity, Light and Sound	(112)	3
Engineering Drawing Descriptive Geometry	(103)	3	Engineering Drawing Machine Sketching	(104)	3
Ceramic Engineering Ceramic Chemistry	(101)	4	Ceramic Engineering Laboratory	(102)	4
Ceramic Engineering Clays	(141)	3	Ceramic Engineering Clay Wares	(142)	3
Military Drill		1	Military Drill		1

THIRD YEAR

Mechanics Statics and Strength of Materials	(101)	5	Mechanics Strength of Materials	(104)	2
Chemistry Physical Chemistry	(159)	3	Geology	(168)	3
Mine Engineering Mine Surveying	(103)	4	Civil Engineering Trusses	(124)	3
Ceramic Engineering Drying and Burning	(143)	3	Ceramic Engineering Decoration of Clay Wares	(144)	3
Ceramic Engineering Calculations	(105)	2	Ceramic Engineering Physical, Chemical Measurements	(108)	3
Mine Engineering Mine Trip	(109)	1	Mechanical Engineering Mechanism and Design	(110)	3

FOURTH YEAR

FIRST SEMESTER			SECOND SEMESTER		
Ceramic Engineering Laboratory	(111)	5	*Ceramic Engineering Laboratory	(112)	5
Ceramic Engineering Drawing	(113)	5	Ceramic Engineering Drawing	(114)	5
Metallurgy Fuel	(117)	2	*Ceramic Engineering Cement Lectures	(118)	5
Metallurgy Iron and Steel	(119)	2	Civil Engineering Cement and Concrete	(118)	3
Metallurgy Pyrometry	(125)	1	Ceramic Engineering Thesis	(116)	4
Mineralogy Physical Chemical Mineralogy	(105)	2			

For thesis requirements see page 15.

---

*Alternative courses. One must be taken.

CHEMICAL ENGINEERING

FOR FIRST YEAR, SEE PAGE 21

SECOND YEAR

Mathematics Calculus	(141)	5	Mathematics Calculus	(142)	5
Physics General Physics	(111)	3	Physics General Physics	(112)	3
Engineering Drawing Descriptive Geometry	(103)	3	Engineering Drawing Machine Sketching	(104)	3
Chemistry Quantitative Analysis	(119)	4	Chemistry Quantitative Analysis	(120)	4
Chemistry Advanced General Chemistry	(113)	2	Chemistry Advanced General Chemistry	(114)	2
Military Drill		1	Chemistry Chemical Problems	(124)	1
			Military Drill		1

THIRD YEAR

Mechanics Statics and Strength of Materials	(101)	5	Mechanics Kinetics and Hydraulics	(102)	5
Engineering Drawing Technical Drawing	(121)	2	Engineering Drawing Technical Drawing	(122)	2
Metallurgy Fuel	(117)	2	Mineralogy Mineralogy and Crystallography	(102)	3
Metallurgy Iron and Steel	(119)	2	Chemistry Organic Chemistry, lectures	(152)	2
Chemistry Organic Chemistry, lectures	(151)	2	Elective		5 to 7
Chemistry Organic Chemistry, laboratory	(153)	2			
Mechanical Engineering Steam Engineering	(107)	3			

Electives in third year, second semester must be chosen from the following courses, subject to approval of the departments concerned: Chemistry (136) 2, Chemical Literature; Chemistry (154) 2 or 3, Advanced Organic Chemistry; Chemistry (168) 3 to 5, Advanced Qualitative Analysis; Chemistry (176) 3, Sanitary Analysis; Chemistry (187) 2 or 3, Inorganic Preparations; Chemistry (192) 2, Rare Elements: (given only in odd numbered years); Metallurgy (110) 4, General Metallurgy; Metallurgy (112) 2, Calorimetry and Mine Gas Analysis.

FOURTH YEAR

FIRST SEMESTER		SECOND SEMESTER	
Mechanical Engineering ....(127) Machine Design	5	Mechanical Engineering ....(144) Machine Design	5
Chemistry ....(157) Physical Chemistry	3	Chemistry ....(158) Physical Chemistry	3
Chemistry ....(177) Industrial Chemistry	2	Chemistry ....(178) Industrial Chemistry	1
Chemistry ....(185) Industrial Chemistry, laboratory	2	Chemistry ....(186) Industrial Chemistry, laboratory	3
Electrical Engineering ....(101) Elementary Electrical Engineering	5	Chemistry ....(140) Thesis	4
		Chemistry ....(182 or 184) Inspection Trip	1
		Elective	2

For thesis requirements see page 15.

CIVIL ENGINEERING

FOR FIRST YEAR, SEE PAGE 21

SECOND YEAR

Mathematics ....(141) Calculus	5	Mathematics ....(142) Calculus	5
Physics ....(111) General Physics	3	Physics ....(125) General Physics	5
Engineering Drawing ....(105) Descriptive Geometry	3	Engineering Drawing ....(106) Advanced Descriptive Geometry	3
Civil Engineering (101 & 101a).. Land Surveying and Field Practice	4 and 1	Civil Engineering (102 & 102a)... R. R. Surveying and Field Practice	4 and 1
Civil Engineering ....(103) Topographic Drawing	2	Military Drill	1
Military Drill	1		

SUMMER COURSE—Civil Engineering (104 and 111), each four weeks of six days per week. Four credit hours for each course. Field work in surveying. Required in second and third years respectively.

THIRD YEAR

FIRST SEMESTER

Astronomy Geodesy and Least Squares	(104)	3
Mechanics Statics and Strength of Materials	(101)	5
Civil Engineering Topographic Surveying	(105)	3
Civil Engineering Applied Descriptive Geometry	(107)	2
Civil Engineering Sanitary Engineering	(109)	3
Geology	(168)	3

SECOND SEMESTER

Astronomy Geodesy and Least Squares	(105)	3
*Electrical Engineering	(103)	3
Mechanics Kinetics and Hydraulics	(102)	5
Civil Engineering Timber Construction	(108)	3
Civil Engineering Roads and Pavements	(106)	3
†Civil Engineering Stresses in Structure	(110)	4
‡Civil Engineering Trusses	(124)	3
‡Civil Engineering Engineering Reports	(138)	1

FOURTH YEAR

CIVIL ENGINEERING GROUP

Civil Engineering Bridge Design	(113)	4
Civil Engineering Cement and Concrete	(130)	2
Civil Engineering Masonry Construction	(115)	3
Mechanical Engineering Laboratory	(173)	5
*Civil Engineering R. R. Maintenance or	(141)	3
*Civil Engineering Tall Buildings or	(125)	3
*Electrical Engineering	(103)	3

*Civil Engineering Railway Location or	(112)	4
*Civil Engineering Advanced Bridge Design	(114)	4
Civil Engineering Water Supply	(117)	3
Civil Engineering Masonry Structures and Contracts	(116)	3
Civil Engineering Thesis	(122)	3
Civil Engineering Concrete Design	(129)	3
*Mechanical Engineering Hydraulic Machinery or	(142)	2
*Mechanical Engineering Hydraulic Power	(150)	3

For thesis requirements see page 15.

---

*Alternative with Astronomy 105 in Municipal and Sanitary Engineering group.
†Civil Engineering group.
‡Municipal and Sanitary Engineering group.

FOURTH YEAR

MUNICIPAL AND SANITARY ENGINEERING GROUP

FIRST SEMESTER			SECOND SEMESTER		
Civil Engineering Cement and Concrete	(130)	2	Civil Engineering Water Supply	(117)	3
Civil Engineering Masonry Construction	(115)	3	Civil Engineering Masonry Structures and Contracts	(116)	3
Mechanical Engineering Laboratory	(173)	5	Civil Engineering Thesis	(122)	3
Civil Engineering Thesis	(119)	1	Civil Engineering Concrete Design	(129)	3
Civil Engineering Municipal Engineering	(139)	3	Civil Engineering Sanitary and Water Supply Design	(140)	3
*Bacteriology General Bacteriology or *Chemistry Quantitative Analysis	(107) (119)	4 3	*Bacteriology Water Exam., Sewage Disposal, Water Filtration or *Chemistry Sanitary Analysis	(114) (176)	3 3

For thesis requirements see page 15.
Students will not be permitted to change groups during the senior year.
*Alternative courses.

ELECTRICAL ENGINEERING

FOR FIRST YEAR, SEE PAGE 21

SECOND YEAR

Mathematics Calculus	(141)	5	Mathematics Calculus	(142)	5
Physics Mechanics and Heat	(113)	5	Physics Electricity, Light and Sound	(114)	4
Engineering Drawing Descriptive Geometry	(103)	3	Physics Laboratory	(134)	4
Physics Laboratory	(133)	2	Engineering Drawing Machine Sketching	(110)	2
Shopwork Machine Work	(119)	3	Shopwork Advanced Machine Work	(121)	3
Military Drill		1	Military Drill		1

THIRD YEAR

Mechanics Statics and Strength of Materials	(101)	5	Mechanics Kinetics and Hydraulics	(102)	5
Physics Laboratory	(135)	5	Electrical Engineering D. C. Machinery	(104)	5
Mechanical Engineering Heat Power Engineering	(105)	3	Mechanical Engineering Heat Power Engineering	(106)	3
Mechanical Engineering Mechanism	(101)	3	Mechanical Engineering Laboratory	(160)	2
Engineering Drawing Technical	(111)	2	Electrical Engineering Applications, A. C. Prin.	(106 & 108)	3
Electrical Engineering Inspection Trip	(131)				

SUMMER COURSE—Electrical Engineering (139), Experience in Practice. Ten weeks during any summer vacation. (To be first required of the class graduating in 1922.)

FOURTH YEAR

FIRST SEMESTER		SECOND SEMESTER	
Mechanical Engineering (175) Laboratory	3	Electrical Engineering (112) A. C. Laboratory	3
Electrical Engineering (111) A. C. Laboratory	3	Electrical Engineering (124) Transmission	3
Electrical Engineering (109) A. C. Machinery	3	Industrial Arts (112) Machine Design	2
Electrical Engineering (121) Elec. Machine Design	3	Electrical Engineering (128) Thesis	5
Electrical Engineering (*)	2	Electrical Engineering (130 or 134) Inspection Trip	
Electrical Engineering (127) Thesis	1	Elective	2 to 5
Elective	2 to 4		

For thesis requirements see page 15.

*One of the following: (113) Railways, (115) Telephones, (117) Illumination, (119) Wireless Telegraphy.

GENERAL ENGINEERING

FOR FIRST YEAR, SEE PAGE 21

SECOND YEAR

Mathematics (141) Calculus	5	Mathematics (142) Calculus	5
Chemistry (119) Quantitative Analysis	4	*Chemistry (120) Quantitative Analysis	4
Physics (113)	5	Physics (114)	4
Engineering Drawing (103)	3	*Physics (136)	4
Military Drill	1	Engineering Drawing (104)	3
		Military Drill	1

(1) In addition to the two years outlined above, the student shall obtain credit for 68 semester hours in order to complete the requirements for his degree.

(2) Of these 68 hours, 10 hours must be Mechanics 101 and 102, which shall ordinarily be completed during the third year.

(3) At least 20 hours shall be selected from technical engineering subjects, and 20 hours shall be selected from either technical engineering subjects or from those sciences fundamental to engineering which are included in the Bulletin of the College of Engineering. These subjects must be approved by the engineering department in which the student's principal work is done, and by the Secretary of the College of Engineering.

(4) The production of a thesis shall be optional with the student, subject to the approval of the department concerned.

(5) The remaining 18 hours shall be selected from any work of the University to which the student is eligible, subject to the approval of the Engineering Department having supervision over the last two years of the student's work.

For thesis requirements see page 15.

*Alternative courses. One must be taken.

MECHANICAL ENGINEERING

FOR FIRST YEAR, SEE PAGE 21

SECOND YEAR

FIRST SEMESTER			SECOND SEMESTER		
Mathematics Calculus	(141)	5	Mathematics Calculus	(142)	5
Physics Mechanics and Heat	(113)	5	Physics General Physics	(119)	3
Engineering Drawing Descriptive Geometry	(103)	3	Physics Laboratory	(138)	2
Shopwork Foundry	(105)	2	Engineering Drawing Machine Sketching	(104)	3
Shopwork Chipping and Filing	(107)	2	Shopwork Machine Shop	(119)	3
Shopwork Advanced Pattern Making	(111)	1	Civil Engineering Surveying	(128)	2
Military Drill		1	Military Drill		1

THIRD YEAR

Mechanics Statics and Strength of Materials	(101)	5	Mechanics Kinetics and Hydraulics	(102)	5
Engineering Drawing Technical Drawing	(111)	2	Architecture Photography	(111)	2
Metallurgy Fuel	(117)	2	Civil Engineering Timber and Masonry	(126)	2
Metallurgy Iron and Steel	(119)	2	Mechanical Engineering Mechanism	(114)	3
Mathematics Differential Equations	(151)	1	Mechanical Engineering Mechanical Drawing	(116)	1
Mechanical Engineering Steam Power Plants	(103)	3	Mechanical Engineering Laboratory	(164)	2
Shopwork Advanced Machine Shop	(121)	3	Mechanical Engineering Steam Power Plants	(104)	4

FOURTH YEAR

Civil Engineering Trusses	(124)	3	*Industrial Arts Shop Buildings	(114)	2
Electrical Engineering Elementary Elec. Engineering	(101)	5	*Mechanical Engineering Steam Turbines	(146)	2
Mechanical Engineering Machine Design	(127)	5	*Mechanical Engineering Hydraulic Power	(150)	3
Mechanical Engineering Gas Engines and Producers	(125)	2	Mechanical Engineering Machine Design	(144)	5
Mechanical Engineering Thermodynamics	(129)	2	Mechanical Engineering Hydraulic Machinery	(142)	2
Mechanical Engineering Laboratory	(179)	2	Mechanical Engineering Laboratory	(190)	6
			Mechanical Engineering Thesis	(148)	3
			Mechanical Engineering Inspection Trip	(130 or 134)	

For thesis requirements see page 15.

*Alternative courses. One must be taken.

MINE ENGINEERING

FOR FIRST YEAR, SEE PAGE 21

SECOND YEAR

FIRST SEMESTER			SECOND SEMESTER		
Mathematics Calculus	(141)	5	Mathematics Calculus	(142)	5
Physics General Physics	(111)	3	Physics General Physics	(112)	3
Engineering Drawing Descriptive Geometry	(103)	3	Engineering Drawing Machine Sketching	(104)	3
Chemistry Quantitative Analysis	(119)	3	Metallurgy Laboratory	(106)	4
Mine Engineering Mine Surveying	(103)	4	Mineralogy Mineralogy and Crystallography	(102)	3
Military Drill		1	Mine Engineering Mine Trip	(110)	
			Military Drill		1

THIRD YEAR

FIRST SEMESTER			SECOND SEMESTER		
Mechanics Statics and Strength of Materials	(101)	5	Mechanics Kinetics and Hydraulics	(102)	5
Metallurgy Fuel	(117)	2	Metallurgy General Metallurgy	(110)	4
Metallurgy Iron and Steel	(119)	2	Metallurgy Calorimetry, Mine Gas Analysis	(112)	2
Metallurgy Fire Assaying	(105)	2	Mineralogy Determinative Mineralogy	(104)	3
Metallurgy Laboratory	(107)	3	Geology Petrography	(166)	2
Geology General Geology	(165)	3	Civil Engineering Trusses	(124)	3
Mine Engineering Mining Problems	(117)	2			

FOURTH YEAR

FIRST SEMESTER			SECOND SEMESTER		
Mine Engineering General Mining	(105)	5	Mine Engineering General Mining	(106)	5
Metallurgy Metallurgical Construction	(111)	2	Mine Engineering Plans and Specifications	(104)	4
Metallurgy Ore Dressing	(113)	2	Mechanical Engineering Laboratory	(192)	3
Electrical Engineering	(103)	3	*Mine Engineering Thesis	(116)	3
Geology Economic Geology	(167)	3	*Metallurgy Thesis	(116)	
Architecture Photography	(111)	2	Metallurgy Metallography	(120)	2
			Mine Engineering Ventilation Control	(120)	2
			Metallurgy Pyrometry and Calorimetry	(122)	1

For thesis requirements see page 15.
*Alternative courses. One must be taken.

RESERVE OFFICERS TRAINING CORPS

The Faculty of the College of Engineering has passed the following regulations to enable its students to take advantage of the Reserve Officers Training Corps. See page 15.

1. That the first two years of the various engineering curricula remain as they are at present.

2. That those students who have completed two academic years of service in the Senior Division of the Reserve Officers Training Corps, and who have been selected for further military training by the President of the University and the Professor of Military Science and Tactics, and who execute the written agreement or contract to pursue the two years advanced curriculum, as prescribed in Section 35 of General Order No. 49, shall receive no academic credit for the prescribed physical work or military drill of said advanced curriculum, but may receive academic credit to the amount of three hours per week during four semesters for the theoretical instruction in military subjects of said curriculum.

3. That a student taking this special military training shall be allowed to substitute, during four semesters, three credit hours of military subjects for which academic credit is given, for the same number of hours of subjects which are now a part of the curriculum leading to the degree sought.

4. That the selection of the subjects in the present curricula for which military credits may be substituted shall be determined by the Executive Committee of the College and the department in which the major work of the student lies.

COMBINATION CURRICULA

Combination curricula leading to two engineering degrees, can be arranged for any two of the foregoing degrees. The amount of additional time will be at least thirty semester hours in excess of that required for one, and may be more. In no case will the student be required to take all of the work not common to the two curricula as published.

For instance a joint curriculum, Mechanical and Electrical Engineering, can be taken in five years. Where the curricula are more diverse, such as Civil Engineering and Mechanical Engineering, six years may be required.

ARTS-ENGINEERING CURRICULA

For the benefit of those who desire to possess the advantage of a wider general culture and a broader foundation than can be given in the limits of a four-year professional curriculum, a combination of three years in the College of Arts, Philosophy and Science and three years in the College of Engineering can be so adjusted as to enable the student to secure the degree of Bachelor of Arts and the appropriate engineering degree.

The College of Engineering desires to establish similar relations with other educational institutions of approved standing in Ohio and elsewhere, by which a student can earn two degrees in five or six years.

GRADUATE WORK

The Graduate School has administrative control of the graduate work in all of the colleges of the University. The conditions under which advanced degrees can be obtained by graduates of the College of Engineering are as follows:

Master's Degree. The degree which will usually be conferred upon candidates whose major work lies in Engineering, will be that of Master of Science, (M. Sc.) The course of study will consist of one major and either one or two minors, at least one of the minors being in a different department from that in which the major is taken. A residence of one year devoted wholly to graduate work is required, but graduates of this University may complete not more than half of the required work at another institution offering equivalent opportunities for study. Except in certain special cases, a satisfactory thesis is required.

Professional Engineering Degree. Upon nomination by the Faculty of the College of Engineering, the appropriate professional engineering degree of Architect, Architectural Engineer, Ceramic Engineer, Chemical Engineer, Civil Engineer, Electrical Engineer, Engineer of Mines, or Mechanical Engineer may be granted to graduates of this University upon any one of the following plans:

First. Four years of acceptable professional experience and an approved thesis.

Second. A Master of Science degree from this University with a major in engineering, followed by two years of acceptable professional experience and an approved thesis.

Third. One year of acceptable professional experience, followed by one year of approved study at this University, with an appropriate engineering major, and an approved thesis.

TWO-YEAR CURRICULA

CLAYWORKING

Second Year

Offered Only During Year 1918-1919

First Semester		
Ceramic Engineering Ceramic Chemistry	(101)	4
Ceramic Engineering Drying and Burning of Clay Wares	(143)	3
Ceramic Engineering Calculations	(105)	2
Ceramic Engineering Laboratory	(115)	2
Physics Elementary Physics	(101)	6
Military Drill		1

Second Semester		
Ceramic Engineering Ceramic Chemistry	(102)	3
Ceramic Engineering Glazing and Decorating of Clay Wares	(144)	3
Ceramic Engineering Laboratory	(126)	5
Ceramic Engineering Dryer and Kiln Design	(122)	4
Military Drill		1

INDUSTRIAL ARTS

Second Year

Offered Only During Year 1918-1919

Engineering Drawing Descriptive Geometry	(103)	3
Chemistry Elementary Chemistry	(101)	4
Physics Elementary Physics	(101)	6
Shopwork Machine Work	(119)	3
Military Drill		1

Engineering Drawing Machine Sketching	(104)	3
Chemistry Elementary Chemistry	(102)	4
Industrial Arts Machines	(101)	3
Industrial Arts Designing	(103)	1
Shopwork Advanced Machine Work	(121)	3
Shopwork Advanced Pattern Making	(130)	3
Military Drill		1

MINING

Second Year

Offered Only During Year 1918-1919

Engineering Drawing Freehand and Lettering	(113)	4
Chemistry Elementary Chemistry	(101)	4
Mine Engineering Mine Plans	(107)	2
Mine Engineering Mine Surveying	(101)	5
Military Drill		1

Engineering Drawing Mechanical Drawing	(114)	3
Geology Elementary Geology	(164)	3
Metallurgy Water Supply and Mine Gases	(102)	4
Mine Engineering General Mining	(102)	5
Military Drill		1

DEPARTMENTS OF INSTRUCTION

ARCHITECTURE

Office, 105 Brown Hall

PROFESSORS BRADFORD, CHUBB, AND SMITH,
MR. HASKETT, MR. RONAN

131. Elements of Architecture. Two credit hours. First semester. Architecture, first year; Architectural Engineering, second year. Concurrent with Art 131, Engineering Drawing 101.

132. Elements of Architecture. Two credit hours. Second semester. Architecture, first year; Architectural Engineering, second year. Prerequisite, Architecture 131, and concurrent with Art 132 and Engineering Drawing 102.

133. History of Architecture. Three credit hours. First semester. Architecture and Architectural Engineering, second year. Concurrent, Architecture 131 and Art 131.

134. History of Architecture. Three credit hours. Second semester. Architecture and Architectural Engineering, second year. Prerequisite, Architecture 133.

135. History of Architecture. Two credit hours. First semester. Architecture and Architectural Engineering, third year. Prerequisite, Architecture 134.

History of Renaissance architecture.

136. History of Architecture. Three credit hours. Second semester. Architecture, third year. Prerequisite, Architecture 135.

History of modern architecture.

141. Design. Five credit hours. First semester. Architecture, second year; Architectural Engineering, third year. Prerequisite, Architecture 132.

142. Design. Five credit hours. Second semester. Architecture, second year; Architectural Engineering, third year. Prerequisite, Architecture 141.

150. Wood Construction. Five credit hours. Second semester. Architecture and Architectural Engineering, third year. Prerequisite, Architecture 141 and Mechanics 103.

143. Design. Five credit hours. First semester. Architecture, third year; Architectural Engineering, fourth year. Prerequisite, Architecture 142.

144. Design. Five credit hours. Second semester. Architecture, third year. Prerequisite, Architecture 143.

145. Design. Five credit hours. First semester. Architecture, fourth year. Prerequisite, Architecture 144.

146. Design. Five credit hours. Second semester. Architecture, fourth year. Prerequisite, Architecture 145.

123. Fire Protection. Two credit hours. Second semester. Architectural Engineering, fourth year. Concurrent, Civil Engineering 125.

151. Masonry. Three credit hours. First semester. Architecture and Architectural Engineering, fourth year. Prerequisite, Architecture 150.

147. Ornament. Four credit hours. First semester. Architecture, fourth year. Prerequisite, Architecture 144 and 113.

153. Plumbing. Two credit hours. First semester. Architectural Engineering, fourth year.

111. Photography. Two credit hours. Either semester. Architecture, Architectural Engineering, Mechanical Engineering, and Civil Engineering, third year; Mine Engineering, fourth year. Prerequisite, Chemistry 105-106, or 109-110. Mr. Haskett.

113. Principles of Architectural Composition. Two credit hours. First semester. Architecture, third year. Prerequisite, Architecture 134. Mr. Chubb.

116. Professional Practice. Four credit hours. Second semester. Architecture, fourth year. Prerequisite, Architecture 151. Mr. Bradford.

117. Sanitary Plumbing. One credit hour. First semester. Architecture, fourth year. Mr. Bradford.

118. Thesis. Five credit hours. Second semester. Architecture, fourth year. Mr. Bradford, Mr. Chubb, Mr. Ronan.

120. Summer Work. Four credit hours. The equivalent of four weeks of work in an architect's office, or a problem in design assigned by the department. Between the second and third years.

121. Summer Work. Four credit hours. The equivalent of four weeks of work in an architect's office, or a problem in design assigned by the department. Between the third and fourth years.

122. Photography. Two credit hours. Second semester. Prerequisite, Architecture 111. Mr. Haskett.

124. Shades, Shadows, and Perspective. Three credit hours. Second semester. Architecture, second year. Prerequisite, Engineering Drawing 107. Mr. Ronan.

FOR GRADUATES

201-202. Architecture.

203-204. Architecture. Research Work.

For description of graduate courses in this department see the Bulletin of the Graduate School.

ART

Office, 201 Horticulture Building

PROFESSOR KELLEY, ASSISTANT PROFESSOR ROBINSON, MR. NORRIS, MR. CHRISTENSEN, MISS TALBOT

131-132. Elementary Drawing. Two credit hours. The year. Four laboratory hours each week. Architecture, second year.

This course is designed to develop a thorough knowledge of form and values in black and white, also the use of freehand perspective.

Art 131 is given also during the second semester.

133. Advanced Drawing. Two credit hours. Either semester. Four laboratory hours each week. Architecture, third year. Prerequisite, Art 131-132.

This course is designed to give the student some freedom in the use of drawing as a medium of expression. Drawing from the antique and the costume model.

141. Elementary Design. Two credit hours. Either semester. Prerequisite, Art 131.

The principles of the theory and practice of design.

161-162. Water Color. Two credit hours. The year. Architecture, third year. Prerequisite, Art 133.

163-164. Drawing from Life. Two credit hours. The year. Architecture, fourth year.

ASTRONOMY

Office, Emerson McMillin Observatory

PROFESSOR LORD, ASSOCIATE PROFESSOR MANSON

104-105. Astronomy, Geodesy, and Least Squares. Three credit hours. The year. Civil Engineering, third year. Prerequisite, the calculus. Mr. Lord, Mr. Manson.

107-108. Advanced Astronomy.

109-110. The Theory of Lenses.

111-112. Introduction to Celestial Mechanics.

For description of graduate courses in this department see the Bulletin of the Graduate School.

CERAMIC ENGINEERING

Office, 26 Lord Hall

PROFESSOR WATTS, RESEARCH PROFESSOR ORTON, ASSISTANT PROFESSORS HARROP AND WILSON, MR. LYSATT

101. Ceramic Chemistry. Four credit hours. First semester. Ceramic Engineering and Short Clayworking, second year. Prerequisite, Chemistry 106 or 110.

Quantitative analysis of limestone and simple minerals.

102. Ceramic Chemistry. Four credit hours. Second semester. Ceramic Engineering, second year. Prerequisite, Ceramic Engineering 101.

Quantitative analysis of clays, fire-gases, etc.

105. Ceramic Calculations. Two credit hours. First semester. Ceramic Engineering, third year; Short Clayworking, second year. Prerequisite, Ceramics 101. Mr. Harrop.

Calculations involved in blending of ingredients used in ceramic mixtures; determinations of limits of variation in given series; limits of errors; volume calculations; problems in heat.

108. Physical and Chemical Measurements of Clays. Three credit hours. Second semester. Ceramic Engineering, third year. Mr. Watts.

Application of physical chemical laws to fusions of mineral mixtures; determination of melting points; deformation periods; relative viscosity of fused magmas; study of influence of salts on viscosity of slips; etc.

111-112. Laboratory Work in Ceramics. Five credit hours. The year. Ceramic Engineering, fourth year. Prerequisite, Ceramics 108 and 144. Mr. Watts.

Practice in clay testing and measurement of physical properties of clays; the production of bodies made from single clays and of clays with minerals. In each case the bodies are burned and tested. The production of slips, engobes and glazes, and the study of the methods of coloring.

113-114. Ceramic Designing. Five credit hours. The year. Ceramic Engineering, fourth year. Prerequisite, Ceramics 144. Mr. Harrop.

Designing, estimating cost of, and writing specifications for kilns and dryers.

The work started in Ceramics 113 is extended to the design and equipment of clayworking plants.

115. Laboratory Work in Ceramics. Two credit hours. First semester. Short Clayworking, second year. Concurrent, Ceramics 143. Mr. Watts.

Testing of clays and minerals employed in clay manufacture and in blending of same for ceramic purposes.

116. Thesis. Four credit hours. Second semester. Ceramic Engineering, fourth year.

118. Cement Manufacture. Five credit hours. Second semester. Alternative with Ceramics 112, Ceramic Engineering, fourth year. Prerequisite, Ceramics 102 and 144. Mr. Harrop.

The theory of hydraulicity, the compounding, manufacture, and testing of natural and Portland cements, and other hydraulic bodies.

122. Dryer and Kiln Design. Four credit hours. Second semester. Short Clayworking, second year. Prerequisite, Ceramics 105. Mr. Harrop.

A graphic study of dryer and kiln design.

126. Laboratory Work in Ceramics. Five credit hours. Second semester. Short Clayworking, second year. Prerequisite, Ceramics 115. Mr. Watts.

The preparation of slips, engobes, and glazes, and the study of the methods of coloring.

141-142. Ceramic Lectures. Three credit hours. The year. Ceramic Engineering, second year. Mr. Harrop.

Origin of clays, constitution, properties, and winning of ceramic materials. General principles of the preparation and forming of clay wares.

143-144. Ceramic Manufacture. Three credit hours. The year. Ceramic Engineering, third year; Short Clayworking, second year. Mr. Watts, Mr.Harrop.

The drying and burning of clay wares. Glazing and decoration of clay wares.

FOR GRADUATES

201-202. Research Work.

203-204. Testing of Clays with Reference to their Industrial Adaptability.

205-206. Porcelain for Electrical and Other Special Purposes.

208. Advanced Experimental Work.

For description of graduate courses in this department see the Bulletin of the Graduate School.

CHEMISTRY

Office, 100 Chemistry Hall

PROFESSORS MCPHERSON, HENDERSON, FOULK, W. L. EVANS,
AND WITHROW, ASSISTANT PROFESSORS BOORD
AND OLIN, MR. DAY, MR. YOUNG, MR. ADKINS,
MR. COITH, AND DEPARTMENT ASSISTANTS

101. Elementary Chemistry. Four credit hours. First semester. One lecture, one quiz, six laboratory hours each week. Short Mining, second year. Mr. Evans, Mr. Day.

A general introductory course on the chemistry of the non-metals.

It is distinctly elementary in character and is arranged for students in short courses only. No credit is allowed for it in the regular four-year courses. Students taking this course should follow with Chemistry 102, second semester.

102. Elementary Chemistry and Qualitative Analysis. Four credit hours. Second semester. Continuation of Chemistry 101. Short Course. Mr. Evans, Mr. Day.

A general introductory course on the chemistry of the metals. The laboratory work deals with the elementary principles of qualitative analysis. No credit is allowed for it in the regular four-year courses.

105. Elementary Chemistry. Four credit hours. Either semester. One lecture, one quiz, and six laboratory hours each week. Required of first-year students in all four-year courses who have not presented chemistry as an entrance credit. Mr. Evans, Mr. Day, Mr. Young, Mr. Adkins, and department assistants.

A general course on the chemistry of the non-metals.

106. Elementary Chemistry and Qualitative Analysis. Four credit hours. Second semester. A continuation of Chemistry 105. Mr. Evans, Mr. Day, Mr. Young, Mr. Adkins, and department assistants.

A general course in the chemistry of the metals. The laboratory work accompanying is a general introductory course in qualitative analysis.

109. General Chemistry. Four credit hours. Either semester. One lecture, one quiz, and six laboratory hours each week. Taken by first-year students in all four-year courses who have presented chemistry as an entrance credit. Mr. Evans, Mr. Day, Mr. Young, Mr. Adkins and department assistants.

A general course on the chemistry of non-metals.

110. General Chemistry and Qualitative Analysis. Four credit hours. Second semester. A continuation of Chemistry 109. Mr. Evans, Mr. Day, Mr. Young, Mr. Adkins, and department assistants.

A general course in the chemistry of the metals. It is more advanced than Chemistry 106. The laboratory work is a general course in qualitative analysis.

113-114. Advanced General Chemistry. Two credit hours. The year. Two lectures each week. Chemical Engineering, second year. Prerequisite, Chemistry 106 or 110. Mr. Henderson.

A course on the fundamental topics of general chemistry designed as a thorough review and extension of the first-year courses.

117. Qualitative Analysis. Three credit hours. First semester. One lecture and six laboratory hours each week. Prerequisite, an acceptable course in general chemistry. Mr. Olin.

119. Quantitative Analysis. (a) Three credit hours. First semester. One lecture and six laboratory hours each week. Mine Engineering, second year. (b) Four credit hours. First semester. One lecture and nine laboratory hours each week. Chemical Engineering, second year. Prerequisite, Chemistry 106 or 110. It is desirable that this course be accompanied by Chemistry 113. Mr. Foulk, Mr. Olin, Mr. Hollingsworth.

The elementary principles of gravimetric and volumetric analysis.

120. Quantitative Analysis. Four credit hours. Second semester. One lecture and nine laboratory hours each week. Chemical Engineering, second year. Prerequisite, Chemistry 119. Mr. Foulk, Mr. Olin, Mr. Hollingsworth.

A continuation of Chemistry 119 with typical analytical methods in gravimetric and volumetric analysis. This course should be accompanied by Chemistry 124. It is desirable that it be accompanied by Chemistry 114.

124. Chemical Problems. One credit hour. Second semester. Chemical Engineering, second year. Mr. Foulk, Mr. Hollingsworth.

Extended practice in the solution of problems pertaining to gravimetric and volumetric analysis. This course is arranged to accompany Chemistry 120.

136. The Reading of Chemical Literature. Two credit hours. Second semester. Chemical Engineering, elective, third year. Prerequisite, one year of German. Mr. Foulk.

The object of this course is to afford practice in the rapid reading of German chemical literature, the selections being made with special reference to the technical terms of the science.

140. Thesis. Four credit hours. Second semester. Chemical Engineering, fourth year. Mr. McPherson, Mr. Henderson, Mr. Withrow, Mr. Foulk, Mr. Evans, Mr. Olin.

151-152. Organic Chemistry. Two credit hours. The year. Two lectures each week. Chemical Engineering, third year. Prerequisite, Chemistry 114 and 120. Mr. McPherson.

General course in organic chemistry.

153-154. Organic Chemistry. Two or three credit hours. The year. Six or nine laboratory hours each week. Chemical Engineering, third year. Must be accompanied or preceded by Chemistry 151 and 152. Mr. McPherson, Mr. Boord.

A general course in the preparation of typical organic compounds.

155. Quantitative Organic Analysis. Two credit hours. First semester. Six hours conference and laboratory work each week. Elective. Prerequisite, Chemistry 153-154. Mr. Boord.

The ultimate analysis of organic compounds and the determination of radicals.

156. Qualitative Organic Analysis. Two credit hours. Second semester. Six hours conference and laboratory work each week. Elective. Prerequisite, Chemistry 153-154. Mr. Boord.

A study of the systematic classification of organic compounds for analysis. Separation, purification and identification of organic compounds.

157-158. Physical Chemistry. Three credit hours. The year. Three lectures each week. Chemical Engineering, fourth year; Ceramic Engineering, third year. Prerequisite, Chemistry 114, 120, and 152. Mr. Henderson.

This is a general course in physical chemistry.

159. Physical Chemistry. Three credit hours. First semester. Three recitations each week. Ceramic Engineering, third year. Prerequisites, Ceramics 102 or Chemistry 120. Mr. Henderson.

A course in the practical application of physical chemistry, with emphasis upon the phase rule, the properties of solutions and colloids.

For advanced undergraduates and graduates.

161. Physical Chemistry. Two or three credit hours. Either semester. Six or nine laboratory hours each week. Elective. Prerequisite or concurrent, Chemistry 157. Mr. Henderson.

A laboratory course designed to illustrate the general lecture course 157-158.

165. Quantitative Analysis. Two credit hours. First semester. Two recitations each week. Prerequisite, Chemistry 119-120, or equivalent. Mr. Foulk.

Advanced course. A general survey of the methods of quantitative analysis.

167. Special Methods of Analysis. Three to five credit hours. First semester. One lecture and six to twelve laboratory hours each week. Chemical Engineering, elective, third year. Prerequisite, Chemistry 119-120. Mr. Olin.

Selections may be made from gas analysis, micro-chemical analysis and spectrum analysis. Time to be arranged.

168. Qualitative Analysis. Three to five credit hours. Second semester. One lecture, six to twelve laboratory hours each week. Chemical Engineering, elective, third year. Prerequisite, Chemistry 120, or equivalent. Mr. Olin.

Advanced course. Extended work in general qualitative analysis including the more important of the rare elements.

169. Quantitative Analysis. Three to five credit hours. First semester. One conference and six to twelve laboratory hours each week. Prerequisite, Chemistry 119-120, or equivalent. Mr. Foulk.

Advanced course. A laboratory course in advanced quantitative analysis.

176. Water Analysis. Three credit hours. Second semester. Two lectures and three laboratory hours each week. Chemical Engineering, elective, third year. Prerequisite, Chemistry 120, or equivalent. Mr. Foulk.

The methods of sanitary and industrial water analysis and interpretation of results.

177. Industrial Chemistry. Two credit hours. First semester. Two lectures each week. Prerequisite, Chemistry 113-114 and 153. Mr. Withrow.

The principles underlying the application of chemistry to the problems of the industries.

178. Industrial Chemistry. One credit hour. Second semester. One lecture each week. Prerequisite, Chemistry 177. Mr. Withrow.

182. Industrial Inspection Trip. A six-day excursion at a suitable time in connection with Chemistry 177-178 for the inspection of industrial chemical processes in actual operation. The entire expense is about $30. A satisfactory report on the work inspected is required. Mr. Withrow, Mr. Coith.

184. Written Reports. A course of assigned reading upon some industrial chemical process and a written report of the same. This is a substitute for Chemistry 182, but the substitution is only allowed upon presentation of reasons satisfactory to the instructor in charge. Mr. Withrow.

185. Industrial Chemistry. Two credit hours. First semester. One conference, five laboratory hours each week. Prerequisite, Chemistry 119-120. Prerequisite or concurrent, Chemistry 177. Mr. Withrow, Mr. Coith.

Industrial chemical research.

186. Industrial Chemistry. Three credit hours. Second semester. One conference, and eight laboratory hours each week. Prerequisite, Chemistry 119-120. Prerequisite or concurrent, Chemistry 177-178. Mr. Withrow, Mr. Coith.

Industrial chemical research and technical analysis.

187. Inorganic Preparations. Three credit hours. Either semester. One recitation and six laboratory hours each week. (Laboratory open afternoons.) Chemical Engineering, elective, third year. Prerequisites, Chemistry 114 and 120. Mr. Henderson, Mr. Mellon.

The preparation of a limited number of compounds chosen so as to give practice in the preparation of inorganic compounds.

192. Rare Elements. Two credit hours. Second semester. Two lectures each week. Elective. Prerequisite, Chemistry 114 and 120. Mr. Henderson.

The chemistry of the rare elements, including a discussion of their increasing economic importance.

194. Applied Electro-Chemistry. Two credit hours. Second semester. Two lectures each week. Elective. Prerequisite or concurrent, Chemistry 158, except by the special permission of the instructor. Mr. Withrow.

The application of the electric current in chemical industries.

FOR GRADUATES

201-202. Physical Chemistry.

205-206. Organic Chemistry.

209-210. Inorganic Preparations.

213. Historical Chemistry.

215. Seminary in Organic Chemistry.

216. Seminary in Organic Chemistry.

***217. Seminary in Organic Chemistry.**

***218. Seminary in Organic Chemistry.**

***221. Seminary in Inorganic Chemistry.**

***224. Seminary in Physical Chemistry.**

225. Seminary in Advanced Industrial Chemistry.

226. Advanced Industrial Chemistry.

227. Scientific Foundations of Analytical Chemistry.

235-236. Research Work.

***239. Seminary in Analytical Chemistry.**

For description of graduate courses in this department see the Bulletin of the Graduate School.

CIVIL ENGINEERING

Office, 108 Brown Hall

PROFESSORS SHERMAN, ENO, AND MORRIS, ASSISTANT PROFESSORS SCHLESINGER AND SLOANE, MR. NEILSON, MR. FAEHNLE, MR. SEEGAR, MR. SHANK

101. Land Surveying. Four credit hours. First semester. Four recitations each week. Civil Engineering, second year. Prerequisite, Mathematics 132, Engineering Drawing 102. Mr. Sherman, Mr. Eno, Mr. Schlesinger, Mr. Sloane.

Care and use of instruments. Farm, city and hydrographic surveying.

---

*Not given in 1918-1919.

101a. Field Practice. One credit hour. First semester. Three hours each week in field. Civil Engineering, second year. Prerequisite or concurrent, Civil Engineering 101. Mr. Schlesinger, Mr. Hindman, and department instructors.

Field exercises in use of instruments and surveying.

102. Railroad Surveying. Four credit hours. Second semester. Four recitations each week. Civil Engineering, second year. Prerequisite, Civil Engineering 101 and 101a. Mr. Sherman, Mr. Schlesinger, Mr. Sloane.

Simple, compound and transition curves, frogs, switches and earthwork.

102a. Field Practice. One credit hour. Second semester. Three hours each week in field. Civil Engineering, second year. Prerequisite or concurrent, Civil Engineering 102. Mr. Schlesinger, Mr. Sloane, and department instructors.

Field practice in laying out curves, frogs, switches and earthwork.

103. Topographic Drawing. Two credit hours. First semester. Six hours each week in drafting room. Civil Engineering, second year. Prerequisite, Engineering Drawing 102. Mr. Sherman, Mr. Eno.

Exercises in black ink and color topographic drawing.

104. Summer Surveying Camp. Four credit hours. Civil Engineering, at close of second year. Prerequisite, Civil Engineering 101a and 102a.

Four weeks of six days each of ten hours a day, from the middle of June to the middle of July.

105. Topographic Surveying. Three credit hours. First semester. Nine hours each week in field or drawing room. Civil Engineering, third year. Prerequisite, Civil Engineering 101, 102, and 104. Mr. Schlesinger, Mr. Sloane.

Field and office work in four or five kinds of topographic surveying.

106. Roads and Pavements. Three credit hours. Second semester. Three recitations each week. Civil Engineering, third year. Prerequisite, Civil Engineering 102 and 104. Mr. Eno.

A study of materials and the principles of construction for rural highways and city pavements.

107. Applied Descriptive Geometry. Two credit hours. First semester. One recitation and one drawing period each week. Civil

Engineering, third year. Prerequisite, Engineering Drawing 106. Mr. Schlesinger, Mr. Sloane.

Descriptive geometry and projections applied to engineering structures in timber, steel, and masonry.

108. Timber Construction. Three credit hours. Second semester. Recitations and drawing. Civil Engineering, third year. Prerequisite, Engineering Drawing 105; concurrent, Mechanics 102. Mr. Schlesinger, Mr. Sloane.

Design of timber structures, identification and properties of various trees and timbers.

109. Sanitary Engineering. Three credit hours. First semester. Three recitations each week. Civil Engineering, third year. Prerequisite, Civil Engineering 102 and 104. Mr. Eno.

A study of the principles of sewerage collection systems as applied to the design of separate and combined sewers and storm drains and the study of sewage disposal.

110. Stresses in Structures. Four credit hours. Second semester. Four recitations each week. Civil Engineering group, third year. Prerequisite or concurrent, Mechanics 102. Mr. Morris.

A course in the theory of stresses in roofs and bridges.

111. Summer Surveying Camp. Four credit hours. Civil Engineering at close of third year. Prerequisite, Civil Engineering 104 and 105.

Four weeks of six days each of ten hours a day, from the middle of June to the middle of July.

112. Railway Location. Four credit hours. Second semester. Four recitations each week. Optional with Civil Engineering 114. Civil Engineering, fourth year. Prerequisite, Civil Engineering 102 and 111 and Mechanics 102. Mr. Sherman.

A railway project used to illustrate engineering economics in construction, operation, and finance.

113. Bridge Design. Four credit hours. First semester. Four recitations each week. Civil Engineering group, fourth year. Prerequisite, Civil Engineering 110. Mr. Morris.

A course in designing and detailing roofs and bridges.

114. Advanced Bridge Design. Four credit hours. Second semester. Four recitations each week. Optional with Civil Engineering 112. Civil Engineering group, fourth year. Prerequisite, Civil Engineering 113. Mr. Morris.

The theory of stresses in and design of cantilever, swing and arch bridges.

115. Masonry Construction. Three credit hours. First semester. Three recitations each week. Civil Engineering, fourth year. Prerequisite, Civil Engineering 111, Mechanics 102. Mr. Sherman.

Review of the materials of masonry construction, and of the general subject of foundations.

116. Masonry Structures and Contracts. Three credit hours. Second semester. Three recitations, lecture, or drawing periods each week. Civil Engineering, fourth year. Prerequisite, Civil Engineering 115. Mr. Sherman.

Dams, retaining walls, piers, abutments, culverts, first two-thirds of term. Contracts and specifications, last third.

117. Water Supply. Three credit hours. Second semester. Three recitations each week. Civil Engineering, fourth year. Prerequisite, Civil Engineering 111, Mechanics 102. Mr. Eno.

A study of hydrology, sources and character of water supply, water borne diseases, construction details of water works, the purification, distribution and operation of public water supplies.

118. Cement and Concrete. Three credit hours. Second semester. Two three-hour laboratory periods each week. Ceramic Engineering, fourth year. Prerequisite, Mechanics 102 or 103.

Recitations and laboratory work in concrete materials including the testing and mixing of them and the theory of stresses in reinforced concrete.

119. Thesis. One credit hour. First semester. Civil Engineering, fourth year. Prerequisite, Civil Engineering 110 and 111.

122. Thesis. Three credit hours. Second semester. Civil Engineering, fourth year. Prerequisite, Civil Engineering 119.

124. Trusses. Three credit hours. Either semester. Three recitations each week first three-fourths of semester, drawing room work last one-fourth of semester. Mechanical Engineering, fourth year; Architecture, Ceramic Engineering, Civil Engineering (Municipal and Sanitary Engineering group), Mine Engineering, third year. Prerequisite or concurrent, Mechanics 102 and 104.

Stresses in and design of steel-framed buildings.

125. Tall Buildings. Three credit hours. First semester. Three lectures or recitations each week. Architectural Engineering, fourth year. Optional in Civil Engineering group, fourth year. Prerequisite, Civil Engineering 124 or concurrent. Civil Engineering 113. Mr. Morris.

Stresses in and design of steel-framed office buildings.

126. Timber and Masonry. Two credit hours. Second semester. Two lectures or recitations each week. Mechanical Engineering, third year. Prerequisite, Mechanics 101. Mr. Schlesinger.

128. Plane Surveying. Two credit hours. Second semester. One lecture and one field exercise of three hours each week. Architecture, fourth year. Mechanical Engineering, second year. Prerequisite, Engineering Drawing 102, Mathematics 132. Mr. Neilson.

129. Concrete Design. Three credit hours. Second semester. Three recitations each week. Architectural and Civil Engineering, fourth year. Prerequisite, Civil Engineering 113 or 124, Mechanical Engineering 123 or 173, and prerequisite or concurrent, Civil Engineering 118 or 130. Mr. Morris.

Design of reinforced concrete structures.

130. Cement and Concrete. Two credit hours. Either semester. Two three-hour laboratory periods each week. Architecture, Architectural and Civil Engineering, fourth year. Prerequisite, Mechanics 102 or 103.

Recitations and laboratory work in concrete materials, including the testing and mixing of them.

138. Engineering Reports. One credit hour. Second semester. One recitation or report period each week. Civil Engineering (Municipal and Sanitary Engineering group), third year. Prerequisite, Civil Engineering 109. Mr. Eno.

Discussions and written reports upon various municipal and engineering activities and structures.

139. Municipal Engineering. Three credit hours. First semester. Three recitations each week. Civil Engineering (Municipal and Sanitary Engineering group), fourth year. Prerequisite, Civil Engineering 106. Mr. Eno.

A course covering city planning, street cleaning and maintenance, garbage and wastes disposal, and kindred subjects.

140. Sanitary and Water Supply Design. Three credit hours. Second semester. One recitation and two drawing periods each week. Civil Engineering (Municipal and Sanitary Engineering group), fourth year. Prerequisite, Civil Engineering 109 and concurrent, Civil Engineering 117. Mr. Eno.

The working of sanitary and water supply problems, assigned readings, the design of sewage collection and water distribution systems, and the design of sewage disposal and water purification plants and appurtenances.

141. Railway Maintenance. Three credit hours. First semester. Three recitations each week. Optional with Civil Engineering 125, Civil Engineering, fourth year. Prerequisite, Civil Engineering 102 and 111. Mr. Schlesinger.

Railway maintenance problems. Design of tracks and structures. Visits of inspection.

FOR GRADUATES

201-202. Investigation and Design.

203. Railway Maintenance of Way.

204. Railway Yards and Terminals.

205. Rail and Water Transportation.

206. River Regulation and Improvement.

207. Design Work in Sewage Disposal Plants.

208. Design Work in Municipal Water Supplies.

209. Advanced Bridge Design.

210. Concrete Structural Design.

For description of graduate courses in this department see the Bulletin of the Graduate School.

ELECTRICAL ENGINEERING

Office, 171 Robinson Laboratory

PROFESSORS CALDWELL AND FLOWERS, MR. SHEPARDSON, MR. BROWN, MR. FARMER, MR. PUCHSTEIN, MR. SCHOTT

101. Electrical Engineering. Five credit hours. First semester. Three lectures and four laboratory hours each week. Chemical Engineering and Mechanical Engineering, fourth year. Prerequisite, Physics 112 or Physics 114. Mr. Shepardson.

Lectures and laboratory work on direct and alternating current circuits, dynamo machinery, transformers, accumulators, and their applications.

103. Electrical Engineering. Three credit hours. Either semester. Two lectures and three laboratory hours each week. Mine Engineering, fourth year. Civil Engineering (Civil Engineering group), fourth year, alternate with Civil Engineering 125 and Civil Engineering 141; Civil Engineering (Municipal and Sanitary Engineering group), third year, alternate with Astronomy 105. Prerequisite, Physics 112 or 114. Mr. Flowers, Mr. Puchstein.

Lectures and laboratory work on direct current machinery, circuits and transmission.

104. Direct Current Machinery. Five credit hours. Second semester. Three lectures and four laboratory hours each week. Electrical Engineering, third year. Prerequisite, Physics 135, Mathematics 142, and Mechanics 101. Mr. Flowers, Mr. Shepardson.

Generators and motors, a study of their theory, construction and operation. Lectures, recitations, problems, and laboratory.

106. Applications of Electricity. One and one-half credit hours. Second semester. Three lectures each week for one-half semester. Electrical Engineering, third year. Prerequisite, Physics 135 and Mathematics 142. Mr. Caldwell.

A brief treatment of the use of electricity, in illumination, railways, telephones, mining, etc.

108. Alternating Current Circuits and Machinery. One and one-half credit hours. Three lectures each week for first half of second semester. Electrical Engineering, third year. Prerequisite, Mathematics 142, Physics 135, Mechanics 101; concurrent, Electrical Engineering 104. Mr. Caldwell.

Elementary treatment of circuits and equipment.

109. Alternating Current Machinery. Three credit hours. First semester. A continuation of Electrical Engineering 108. Three lectures each week. Electrical Engineering, fourth year. Prerequisite, Electrical Engineering 108, concurrent, Electrical Engineering 111. Mr. Caldwell.

Advanced treatment of transformers, synchronous motors, induction motors, etc.

111. Alternating Current Laboratory. Three credit hours. First semester. Electrical Engineering, fourth year. Prerequisite, Electrical Engineering 108; concurrent, Electrical Engineering 109. Mr. Brown, Mr. Farmer.

Alternating current apparatus and accumulators.

112. Advanced Alternating Current Laboratory. Three credit hours. Second semester. Electrical Engineering, fourth year Prerequisite, Electrical Engineering 109 and 111. Mr. Brown, Mr. Farmer.

113. Electric Railways. Two credit hours. First semester. Electrical Engineering, fourth year. Alternative with Electrical Engineering 115, 117, and 119. Prerequisite, Electrical Engineering 104; concurrent, Electrical Engineering 109. Mr. Shepardson.

Systems, apparatus, and railway operation.

115. Telephony. Two credit hours. First semester. Electrical Engineering, fourth year. Alternative with Electrical Engineering 113, 117, and 119. Prerequisites, Electrical Engineering 104 and 108. Mr. Flowers.

Methods of telephone operation, simple circuits, apparatus and elements of transmission theory.

117. Electric Illumination. Two credit hours. First semester. Electrical Engineering, fourth year. Alternative with Electrical Engineering 113, 115, and 119. Architectural Engineering, third year. Prerequisite, Physics 112. Mr. Caldwell.

Principles of illumination, electric lamps, etc.

119. Wireless Telegraphy. Two credit hours. First semester. Electrical Engineering, fourth year. Alternative with Electrical Engineering 113, 115, and 117. Prerequisites, Electrical Engineering 104 and 108. Mr. Brown.

Elementary theory, production, transmission, and detection of damped and undamped oscillations.

121. Electrical Design. Three credit hours. First semester. Two three-hour drawing periods each week. Electrical Engineering, fourth year. Prerequisite, Electrical Engineering 104. Mr. Flowers, Mr. Puchstein.

Design of direct current dynamos, transformers, etc.

122. Electrical Design. Two credit hours. Second semester. A continuation of Electrical Engineering 121. One four-hour drawing period each week. Electrical Engineering, fourth year. Elective. Mr. Flowers.

Alternating current apparatus.

124. Electrical Transmission and Distribution. Three credit hours. Second semester. Three lectures each week. Electrical Engineering, fourth year. Prerequisite, Electrical Engineering 109. Mr. Caldwell.

Transmission and distribution systems, apparatus, organization, and operation.

125-126. Special Reading and Laboratory. Credit hours to be arranged. The year. Elective for fourth year electrical engineering and graduate students with the consent of the instructor in charge. Prerequisites, Electrical Engineering 104 and 108.

127. Thesis. One credit hour. First semester. Electrical Engineering, fourth year. Prerequisites, Electrical Engineering 104 and 108.

128. Thesis. Five credit hours. Second semester. Electrical Engineering, fourth year.

130. Inspection Trip. Electrical Engineering, fourth year. Prerequisite, Mechanics 102.

Includes Pittsburgh, Buffalo, Niagara, and Cleveland. The entire expense need not exceed $35. A satisfactory written report on the work of the trip and an examination are required.

134. Reading Course. Electrical Engineering, fourth year. This may be taken as a substitute for Electrical Engineering 130 on presentation of reasons satisfactory to the head of the department.

Assigned reading on processes of manufacture and power plants.

131. Inspection Trip. First semester. Electrical Engineering, third year. Visits to works of electrical and industrial interest at Columbus, Dayton and other nearby points. A written report and examination are required.

138. Advanced Laboratory. Two credit hours. Second semester. One four-hour laboratory period. Electrical Engineering, fourth year. Elective. Mr. Caldwell.

Selected tests on alternating current, apparatus, illumination, railways, etc.

139. Experience in Practice. Ten weeks during any summer vacation. Electrical Engineering.

The student shall present a satisfactory report upon the work done. This report shall include a discussion of the student's observations upon the human aspects of the work with which he was connected. The occupation, the work done, and the report shall be subject to approval by the department of Electrical Engineering. If a student has had not less than twelve months of satisfactory practical experience, he may be permitted to substitute a satisfactory report upon such practical work for the above requirement.

In case any student is unable to obtain an opportunity for such practical experience as will fulfill the above requirement, he may be permitted by the department to substitute eight credit hours of approved academic courses for the same. This requirement shall first go into effect with the class graduating in 1922.

FOR GRADUATES

201-202. Advanced Alternating Current Machinery.

203-204. Transient Electrical Phenomena.

205-206. Advanced Alternating Current Dynamo Laboratory.

207-208. Research Work.

For description of graduate courses in this department see the Bulletin of the Graduate School.

ENGINEERING DRAWING

Office, 204 Brown Hall

PROFESSOR FRENCH, ASSISTANT PROFESSORS MEIKLEJOHN, WILLIAMS, TURNBULL, AND SVENSEN, MR. FIELD, MR. S. S. WITHROW, MR. WARDER, MR. MARTIN

101. Elementary Mechanical Drawing. Two credit hours. Either semester. All four-year courses, first year. Mr. French and department instructors.

Practice in the use of drawing instruments, elementary projections.

102. Mechanical Drawing. Three credit hours. Either semester. All four-year courses, first year. Prerequisite, Engineering Drawing 101. Lettering, orthographic, isometric, and oblique projections. Mr. French and department instructors.

103. Descriptive Geometry. Three credit hours. First semester. Two recitations, one drawing period each week. Ceramic, Chemical, Electrical, Mechanical, and Mining Engineering, second year. Prerequisite, Engineering Drawing 102 or 114. Mr. French and department instructors.

104. Machine Drawing. Three credit hours. Second semester. One lecture, two drawing periods each week. Ceramic, Chemical, Mechanical and Mine Engineering, second year. Prerequisite, Engineering Drawing 103. Mr. Williams, Mr. Svensen.

105. Descriptive Geometry. Three credit hours. First semester. Two lectures, one drawing period each week. Civil Engineering, second year. Prerequisite, Engineering Drawing 102. Mr. Turnbull.

106. Advanced Descriptive Geometry. Three credit hours. Second semester. Two lectures, one drawing period each week. Civil Engineering, second year. Prerequisite, Engineering Drawing 105. Mr. Turnbull.

107. Descriptive Geometry. Three credit hours. First semester. Two recitations, one drawing period each week. Architecture, second year. Prerequisite, Engineering Drawing 102. Mr. Meiklejohn.

110. Technical Drawing. Two credit hours. Second semester. Electrical Engineering, second year. Prerequisite, Engineering Drawing 103. Mr. Williams.

111. Technical Drawing. Two credit hours. First semester. Mechanical and Electrical Engineering, third year. Prerequisite, Engineering Drawing 104 or 110. Mr. Williams, Mr. Svensen.

121-122. Technical Drawing. Two credit hours. The year. Chemical Engineering, third year. Prerequisite, Engineering Drawing 104. Mr. J. R. Withrow, Mr. Svensen.

Designing of chemical plants and machinery.

ENGLISH

Office, 103 Physics Building

PROFESSOR DENNEY, ASSISTANT PROFESSORS BECK, ANDREWS, AND PERCIVAL, MR. CRAIG, MR. DISHONG, MR. WILEY, MISS ROBINSON, MR. FOLEY, AND DEPARTMENT ASSISTANTS

101. Paragraph Writing: Description and Narration. Two credit hours. Either semester.

English 101 is given also in the Summer Session.

104. Paragraph Writing: Exposition and Argumentation. Two credit hours. Either semester. Prerequisite, English 101.

English 104 is given also in the Summer Session.

GEOLOGY

Office, 104 Orton Hall

PROFESSORS BOWNOCKER AND CARMAN, ASSISTANT PROFESSORS HILLS AND TUCKER, MR. VERWIEBE, MR. COTTINGHAM, MISS MORNINGSTAR

164. Elementary Geology. Three credit hours. Second semester. Short Mining, second year. Mr. Verwiebe.

Lithological, dynamical, structural, and historical geology. Recitations, lectures, and laboratory work.

165. Geology. Three credit hours. First semester. Two recitations and two laboratory hours each week. Mine Engineering, third year. Mr. Carman, Mr. Verwiebe.

During part of the semester, field trips on Saturday morning will take the place of the laboratory work.

The application of the principles of geology to mine engineering. Structural geology, dynamic geology and a briefer consideration of physiographic and historical geology.

166. Petrography. Two credit hours. Second semester. Mine Engineering, third year. Mr. Bownocker.

A study of hand specimens of igneous, metamorphic, and sedimentary rocks. Lectures and laboratory work.

167. Economic Geology. Three credit hours. First semester. Three recitations each week. Mine Engineering, fourth year. Prerequisite, Geology 165 and 166. Mr. Bownocker.

A study is made of the nature of ores, their classification and origin; the metallic ores in the United States, their distribution, abundance, modes of occurrence and origin. The coals of the Appalachian field.

168. Geology. Three credit hours. Either semester. Two recitations and two laboratory hours each week. Ceramic and Civil Engineering, third year. Mr. Carman, Mr. Verwiebe.

During part of the semester, field trips on Saturday morning will take the place of the laboratory work.

The application of the principles of geology to engineering. The study of the common rock-forming minerals and rocks, structural geology, dynamic geology and a briefer consideration of physiographic, historical and economic geology.

FOR GRADUATES

201-202. Advanced Historical Geology.

203-204. Research Work.

For description of graduate courses in this department see the Bulletin of the Graduate School.

GERMAN

Offices, 317 and 318 University Hall

PROFESSORS EVANS AND EISENLOHR, ASSISTANT PROFESSORS
THOMAS, BARROWS, LEWISOHN, AND BUSEY, MR. KOTZ,
AND DEPARTMENT ASSISTANTS

101-102. Elementary German. Four credit hours. The year. Open to students in any four-year course who enter with a foreign language other than German.

The essentials of grammar and oral practice, first semester.

Reading of easy narrative, grammatical drill, second semester.

German 101 is given also during the second semester.

103. Intermediate German. Four credit hours. First semester. Prerequisite, German 102 or two units entrance credit in German. Not open to students who enter with four units entrance credit in German.

Reading of narrative prose, with topical review of grammar. One hour prose composition each week.

German 103 is given also during the second semester.

106. Science Reading. Four credit hours. Second semester. This course is for engineering students; a continuation of German 103 and 107.

Rapid reading of German technical literature. Drill on sentence structure and word formation. The object of the course is to prepare students to read technical works and current technical literature.

107. Advanced German. Four credit hours. First semester. Open to first-year students who enter with four units credit in German. By agreement with the College of Engineering, students may on securing permission, continue this course in the second semester in place of 106.

INDUSTRIAL ARTS AND SHOPWORK

Office, 125 Shop Building

PROFESSOR SANBORN, ASSOCIATE PROFESSOR W. A. KNIGHT, MR. CASE, MR. BEEM, MR. FOUST, MR. DENMAN, MR. BRECKUR, AND DEPARTMENT ASSISTANTS

INDUSTRIAL ARTS

101. Tools and Machines. Three credit hours. Second semester. Three recitations each week. Short Industrial Arts, second year. Prerequisite, Mathematics 114 or 132. Concurrent, Physics 101. Mr. Sanborn.

Principles underlying the construction and operation of machines with a special study of machine tools.

103. Designing. One credit hour. Second semester. Three laboratory hours each week. Short Industrial Arts, second year. Concurrent, Industrial Arts 101. Mr. Sanborn.

112. Machine Design. Two credit hours. Second semester. Four laboratory hours each week. Electrial Engineering, fourth year. Prerequisite, Mechanics 102 and Engineering Drawing 111. Mr. Sanborn.

Practical application of principles of machine design.

114. Shop Building. Two credit hours. Second semester. Two recitations each week. Alternative with Mechanical Engineering 146, fourth year. Prerequisite, Civil Engineering 126. Mr. Sanborn.

Lectures and problems on the construction of shop buildings and the arrangement of machinery; special shop appliances.

For courses in Shopwork see page 79.

MATHEMATICS

Office, 314 University Hall

PROFESSORS BOHANNAN, MCCOARD, SWARTZEL, KUHN, RASOR, AND MORRIS, ASSOCIATE PROFESSOR ARNOLD, ASSISTANT PROFESSORS PRESTON, BAREIS, AND WEST, MISS RICKARD, MR. WEAVER

131. College Algebra and Trigonometry. Five credit hours. Either semester. All four-year courses in Engineering, first year. Prerequisites, Entrance Algebra and Geometry.

132. Plane Trigonometry and Analytical Geometry. Five credit hours. Either semester. All four-year courses in Engineering, first year. Prerequisite, Mathematics 131.

This course is given also in the Summer Session.

141. Calculus. Five credit hours. Either semester. All four-year courses in Engineering, second year. Prerequisite, Mathematics 132.

142. Calculus. Five credit hours. Either semester. Continuation of Mathematics 141. All four-year courses in Engineering, second year. Prerequisite, Mathematics 141.

This course is given also in the Summer Session.

127-128. Analytical Geometry and Calculus. Three credit hours. The year. Architecture, second year. Prerequisite, Mathematics 132.

151. Differential Equations. One credit hour. First semester. Mechanical Engineering, third year. Prerequisite, Mathematics 142.

FOR ADVANCED UNDERGRADUATES AND GRADUATES

Prerequisite: Differential and Integral Calculus.

***163-164. Plane and Solid Analytical Geometry.** Three credit hours. The year. Mr. Morris.

167-168. Differential Equations. Three credit hours. The year. Mr. Bohannan.

---

*Not given in 1918-1919.

173-174. Modern Higher Algebra. Three credit hours. The year. Mr. Kuhn.

FOR GRADUATES

201-202. Theory of Functions of a Complex Variable.

203. Fourier's Series and Spherical Harmonics.

204. Vector Analysis and its Applications.

205-206. Calculus of Variations.

207. History of Mathematics.

***209-210. Theory of Statistics.**

211-212. Groups.

213-214. Differential Geometry.

215-216. Functions of a Real Variable.

217-218. Infinite Series and Products.

219-220. Theory of Numbers.

221-222. Theory of Invariants.

For description of graduate courses in this department see the Bulletin of the Graduate School.

MECHANICAL ENGINEERING

Office, 244 Robinson Laboratory

PROFESSORS MAGRUDER, MARQUIS, NORMAN, AND SANBORN,
ASSOCIATE PROFESSOR JUDD, MR. MAY, MR. FIKRET,
AND DEPARTMENT ASSISTANTS

101. Mechanism. Three credit hours. First semester. Three recitations each week. Electrical Engineering, third year. Prerequisites, Engineering Drawing 103, Physics 114. Mr. Sanborn.

Recitations on the principles of mechanism and mechanical movements.

103. Steam Power Plants. Three credit hours. First semester. Three recitations each week. Mechanical Engineering, third year. Prerequisites, Engineering Drawing 104 and Physics 119; concurrent, Mechanics 101 and Metallurgy 117 and 119. Mr. Marquis.

---

*Not given in 1918-1919.

A descriptive and analytical study of steam-generating and steam-using machinery.

104. Steam Power Plants. Four credit hours. Second semester. Four recitations each week. Mechanical Engineering, third year. Prerequisites, Mechanical Engineering 103 and Metallurgy 117 and 119; concurrent, Mechanics 102. Mr. Marquis.

A continuation of Mechanical Engineering 103.

105-106. Heat Power Engineering. Three credit hours. The year. Three recitations each week. Electrical Engineering, third year. Prerequisites, Engineering Drawing 110 and Physics 114; and concurrent, Mechanics 101 and 102.

A descriptive and analytical study of steam-generating and steam-using machinery, gas and oil engines.

107. Steam Engineering. Three credit hours. First semester. Three recitations each week. Chemical Engineering, third year. Prerequisites, Engineering Drawing 104 and Physics 112.

An elementary descriptive and analytical study of steam-generating and steam-using machinery.

110. Mechanism and Machine Design. Three credit hours. Second semester. Three recitations each week. Ceramic Engineering, third year. Prerequisites, Engineering Drawing 104, Mechanics 101. Mr. Judd.

Recitations on the principles of mechanism, mechanical movements, and elementary machine design.

114. Mechanism. Three credit hours. Second semester. Three recitations each week. Mechanical Engineering, third year. Prerequisites, Engineering Drawing 104, Physics 119. Mr. Sanborn.

Recitations and practice on the principles of mechanism and mechanical movements.

116. Mechanism Drawing. One credit hour. Second semester. One three-hour drawing period each week. Mechanical Engineering, third year. Prerequisite or concurrent, Mechanical Engineering 114. Mr. Sanborn.

Practice in laying out mechanisms and mechanical movements.

121. Heating and Ventilating. Three credit hours. First semester. Three recitations each week. Architecture and Architectural Engineering, fourth year. Prerequisite, Mechanics 103, Physics 112 or 118. Mr. Marquis.

Recitations and lectures on the principles and methods of heating and ventilation.

123. Materials of Construction. Two credit hours. First semester. One recitation and three laboratory hours each week. Architectural Engineering, third year. Concurrent, Mechanics 103. Mr. Judd.

Lectures and recitations on the materials used in architectural and building construction, and laboratory exercises on their properties.

125. Gas Engines and Producers. Two credit hours. First semester. Two recitations each week. Mechanical Engineering, fourth year. Prerequisite, Mechanical Engineering 104. Mr. Magruder.

A study of gas engines and of gas producers as used for power purposes.

127. Machine Design. Five credit hours. First semester. Five recitations each week. Chemical and Mechanical Engineering, fourth year. Prerequisites, Engineering Drawing 104 and 111, Mechanics 101, Metallurgy 117 and 119, Mechanical Engineering 103. Mr. Magruder, Mr. Sanborn.

A detailed course of study based upon mechanics and the materials of construction applied to the design and construction of machinery.

129. Thermodynamics. Two credit hours. First semester. Two recitations each week. Mechanical Engineering, fourth year. Prerequisite, Mechanical Engineering 104. Mr. Magruder.

The transmutations of heat and mechanical energies in steam and air engines, in air and ammonia compressors, and in refrigeration machines, together with a study of the tests of ideal and actual engines and of their indicator diagrams; the flow of gases through pipes and orifices.

130. Inspection Trip. Required in Mechanical Engineering, fourth year. Prerequisite, Mechanics 102.

Includes Pittsburgh, Buffalo, Niagara Falls, Cleveland, and possibly other places. The entire expense need not exceed $35. A satisfactory written report upon the work of the trip and examination are required.

134. Reading Course. Mechanical Engineering, fourth year. Written report on assigned reading upon processes of manufacture and power plant. This may be taken as a substitute for Mechanical Engineering 130 on presentation of reasons satisfactory to the head of the department.

142. Hydraulic Machinery. Two credit hours. Second semester. Two recitations each week. Mechanical Engineering, fourth year. Prerequisites, Mechanics 102, Mechanical Engineering 104. Mr. Judd.

A study of pumping machinery.

144. Machine Design. Five credit hours. Second semester. Three recitations and two three-hour drawing periods each week. Chemical and Mechanical Engineering, fourth year. Prerequisite, Mechanical Engineering 127. Mr. Magruder and Mr. Sanborn.

A continuation of Mechanical Engineering 127, with practical applications on the drawing board of the principles to the design of some particular machine.

146. Steam Turbines. Two credit hours. Second semester. Two recitations each week. Optional in Mechanical Engineering with Mechanical Engineering 150 and Industrial Arts 114, fourth year. Prerequisite, Mechanical Engineering 129. Mr. Marquis.

A study of the generation of power by steam turbines, including auxiliary machinery.

148. Thesis Work. Three credit hours. Second semester. Mechanical Engineering, fourth year. Prerequisites, Mechanical Engineering 125, 127, 129, and 179. Mr. Magruder, Mr. Marquis, Mr. Judd.

A special investigation or design based upon the work of the courses.

150. Hydraulic Power. Three credit hours. Second semester. Two recitations and three laboratory hours each week. Elective in Civil and Electrical, and optional in Mechanical Engineering, fourth year. Prerequisites, Mechanical Engineering 173, 175, or 179. Mr. Judd.

A study of hydraulic turbines and the generation of hydraulic power.

160. Experimental Engineering Laboratory. Two credit hours. Second semester. Four laboratory hours each week. Electrical Engineering, third year. Concurrent, Mechanics 102 and Mechanical Engineering 106. Mr. Marquis, Mr. Judd.

Calibration of pressure gauges and indicator springs; steam engine indicator practice; testing of lubricating oils and the materials of construction.

164. Experimental Engineering Laboratory. Two credit hours. Second semester. Four laboratory hours each week. Mechanical Engineering, third year. Concurrent, Mechanics 102 and Mechanical Engineering 104. Mr. Marquis, Mr. Judd.

Calibration of pressure gauges and indicator springs; steam engine indicator practice; testing of oils and the materials of construction.

169. Experimental Engineering Laboratory. Two credit hours. First semester. Four laboratory hours each week. Architectural Engineering, fourth year. Concurrent, Mechanical Engineering 121. Mr. Marquis.

Investigations of the heating and ventilating plants of different buildings, lay-outs, and laboratory tests of equipments used in such plants.

171. Experimental Engineering Laboratory. Three credit hours. First semester. One recitation and four laboratory hours each week. Elective in Ceramic and Chemical Engineering, fourth year. Prerequisites, Mechanics 101 and 102 or 104. Mr. Judd.

Selected laboratory exercises in the testing of lubricants and the materials of construction; calibration of pressure gauges and indicator springs; steam engine indicator practice; and brake tests of steam engines.

173. Experimental Engineering Laboratory. Five credit hours. First semester. Two recitations and six laboratory hours each week. Civil Engineering, fourth year. Prerequisite, Mechanics 102. Mr. Marquis, Mr. Judd.

Practice in the testing of the materials of construction; calibration of orifices and weirs; study of the flow of liquids and gases; tests of steam, power, rotary, and centrifugal pumps, tests of water motors and turbine water wheels. Lectures and recitations on same and on steam engines, boilers, and transmission machinery.

175. Experimental Engineering Laboratory. Three credit hours. First semester. Six laboratory hours each week. Electrical Engineering, fourth year. Prerequisites, Mechanical Engineering 106 and 160. Mr. Marquis, Mr. Judd.

Tests of steam engines and boilers, of gas and oil engines, and of steam and power pumps; hydraulic experimentation; and the use of transmission and absorption dynamometers.

179. Experimental Engineering Laboratory. Two credit hours. First semester. Four laboratory hours each week. Mechanical Engineering, fourth year. Prerequisite, Mechanical Engineering 164. Concurrent, Mechanical Engineering 125 and 129. Mr. Marquis, Mr. Judd.

Valve setting, moisture determinations in steam, gas calorimetry, measurements of flow of water by means of orifices, nozzles, weirs, and venturi-meter; tests of belts with use of transmission and absorption dynamometers.

190. Experimental Engineering Laboratory. Six credit hours. Second semester. Twelve laboratory hours each week. Mechanical Engineering, fourth year. Prerequisites, Mechanical Engineering 125, 129, and 179. Mr. Marquis, Mr. Judd.

Tests of steam and hot-air engines; steam boilers; gas and oil engines; gas producers; air compressors; injectors and pulsometers; centrifugal, rotary, and power pumps; hydraulic rams, impulse and turbine water wheels; fans and blowers, and steam turbines.

192. Experimental Engineering Laboratory. Three credit hours. Second semester. One recitation and four laboratory hours each week. Mine Engineering, fourth year. Prerequisites, Mechanics 102, Metallurgy 109. Mr. Judd.

Lectures and recitations on power transmission, steam and gas engines, steam boilers, and gas producers. Laboratory work in the calibration of pressure gauges and indicator springs; valve setting; testing of steam engines, testing of steam and centrifugal pumps; boiler and fuel trials; tests of gas engines and gas producers.

FOR GRADUATES

201-202. Research Work.

203-204. Gas Power and Design.

205-206. Gas Power Laboratory Work.

207-208. Steam Power Plant Economics and Design.

209. The Steam Locomotive.

For description of graduate courses in this department see the Bulletin of the Graduate School.

MECHANICS

Office, 219 Lord Hall

PROFESSORS BOYD AND CODDINGTON, MR. DRAFFIN

The laboratory work in strength of material, involving the use of testing machines, is given at present in the Department of Mechanical Engineering.

101. Statics and Strength of Materials. Five credit hours.

First semester. Ceramic, Chemical, Civil, Electrical, Mechanical, and Mine Engineering, third year. Prerequisite, Mathematics 142.

102. Strength of Materials: Kinetics and Hydraulics. Five credit hours. Second semester. Chemical, Civil, Electrical, Mechancal, and Mine Engineering, third year. Prerequisite, Mechanics 101.

103. Statics and Strength of Materials. Five credit hours. First semester. Architecture and Architectural Engineering, third year. Prerequisite, Mathematics 128 or 142.

104. Strength of Materials. Two credit hours. Second semester. Architecture and Ceramic Engineering, third year. Prerequisite, Mechanics 101.

FOR GRADUATES

201-202. Advanced Theoretical Mechanics.

For description of graduate courses in this department see the Bulletin of the Graduate School.

METALLURGY

Office, 100 Lord Hall

PROFESSORS DEMOREST AND SOMERMEIER, MR. E. C. SMITH

102. Mineral Chemistry. Four credit hours. Second semester. Short Mining, second year. Prerequisite, Chemistry 101. Mr. Demorest, Mr. Minor.

A course of lectures upon mine gases, safety lamps, mine explosions, boiler water, mine water, water supply, explosives, coal, and coke.

105. Fire Assaying. Two credit hours. First semester. Mine Engineering, third year. Laboratory three afternoons each week during the last two-fifths of the first semester. Prerequisite, Metallurgy 106 or equivalent. Mr. Demorest, Mr. Smith.

Lectures and laboratory work. Practical work in the assaying of gold, silver and lead ores.

106. Metallurgical Analysis. Four credit hours. Second semester. One lecture, nine laboratory hours each week. Mine Engineering, second year. Prerequisite, Chemistry 106 or 110, Chemistry 119. Mr. Demorest.

Lectures and laboratory work. Laboratory work in the analysis of iron ores, iron and steel, fuel and slags, and ores of lead, zinc, and copper by wet methods, using approved methods as practiced in technical laboratories and metallurgical works.

107. Alloy Analysis. Three credit hours. First semester. One lecture, laboratory three afternoons each week during the first three-fifths of the first semester. Mine Engineering, third year. Prerequisite, Metallurgy 106. Mr. Demorest.

Lectures and laboratory work. Laboratory work in the analysis of alloy steels, such as vanadium, tungsten, chromium, nickel and molybdenum steels and other alloys. Quantitative work preceded by qualitative test on the alloy.

117. Fuel. Two credit hours. First semester. Four recitations each week during first half of first semester. Chemical, Mechanical and Mine Engineering, third year; Ceramic Engineering, fourth year. Prerequisite, Chemistry 106 or 110 and Physics 112 or 114. Mr. Somermeier.

Lectures, recitations and problems on fuels, their properties, uses and manufacture.

119. Iron and Steel. Two credit hours. First semester. A continuation of Metallurgy 117. Four recitations each week during second half of first semester. Chemical, Mechanical and Mine Engineering, third year; Ceramic Engineering, fourth year. Mr. Demorest.

Lectures, recitations and problems on metallurgy of iron and steel.

110. Metallurgy of Non-Ferrous Metals. Four credit hours. Second semester. Mine Engineering, third year. Mr. Demorest.

Lectures and recitations on the metallurgy and properties of the non-ferrous metals; copper, lead, gold, silver, aluminum, zinc.

111. Metallurgical Construction. Two credit hours. First semester. Two recitations during the first half of the first semester and four hours designing during the last half of the first semester. Mine Engineering, fourth year. Prerequisites, Engineering Drawing 111, Mechanics 102, Metallurgy 109 and 113. Mr. Demorest.

Lectures, recitations and practical applications in the drawing room on the designing of furnaces and metallurgical plants.

112. Technical Gas Analysis. Two credit hours. Second semester. Mine Engineering, third year. Two afternoons each week.

Prerequisite, Metallurgy 106, 109, or equivalent. Mr. Demorest.

Laboratory work supplemented by lectures. Technical analysis of metallurgical and mine gases. Determination of the calorific value of gases; problems involving application of results of gas analysis to furnace operation, mine ventilation, etc.

113. Ore Dressing and Coal Washing. Two credit hours. First semester. Mine Engineering, fourth year. Prerequisite, Metallurgy 109. Mr. McCaughey.

Methods of concentrating and enriching ores and fuels by mechanical means. Lectures with references to standard books and various papers in technical journals.

120. Metallography. Two credit hours. Second semester. One hour lecture and three laboratory hours each week, first two-thirds of the semester. Mine Engineering, fourth year, alternate with Mine Engineering 120. Prerequisites, Metallurgy 106, 107, 119, or equivalent. Mr. Smith.

Metallography of iron, steel and industrial alloys. Methods of examination of iron; steel; brass, bronze bearing metals, etc. Relation of chemical composition, physical properties and micro-structure of metal ores.

122. Pyrometry and Calorimetry. One credit hour. Second semester. Mine Engineering, fourth year. One lecture and three laboratory hours each week, last third of the semester. Prerequisites, Metallurgy 106, 107, 119 or equivalent. Mr. Smith.

Exercises in and lectures on the uses and calibration of noble and base metal thermo-couples, optical and radiation pyrometers, bomb calorimeters for liquid and solid fuels and the Junker calorimeter for gaseous fuels.

123. Metallography. Three credit hours. First semester. Elective. One lecture and four laboratory hours each week. Prerequisites, Metallurgy 106, 107, 119 or equivalent. Mr. Smith.

The study of freezing and cooling curves, equilibrium diagrams and their meaning, changes of structure in the solid state of pure metals and alloys, such as copper, steel, brass and bronze. Microscopic examination of commercial metallurgical products and methods of metallographic research.

125. Pyrometry. One credit hour. First semester. Three laboratory hours each week. Ceramic Engineering, fourth year. Mr. Smith.

Exercises in the measurement of high temperatures by standard pyrometric methods using noble and base metal thermo-couples with galvanometer and potentiometer indicators, optical and radiation pyrometers and resistance thermometers and the calibration of pyrometers.

141. Metallurgical Investigation. Three to five credit hours. First semester. Prerequisites, one year of quantitative analysis college physics, and not less than one semester of general metallurgy. Mr. Somermeier, Mr. Demorest.

(a) **Iron, Steel and Other Alloys.** Investigations on the composition, properties, structure and heat treatment. Prerequisite, Metallurgy 114.

(b) **Fuels.** Investigations on composition, conservation and utilization. Prerequisite, Metallurgy 114.

(c) **Investigations on the Metallurgy and Analysis of the Less Common Metals,** as tin, antimony, bismuth, tungsten, etc. Prerequisite, Metallurgy 109.

(d) **Investigation of Special Metallurgy Processes,** as the electrolytic refining of lead, etc. Prerequisite, Metallurgy 109.

116. Thesis. Three credit hours. Second semester.

MILITARY SCIENCE AND TACTICS

Office, 104 Hayes Hall

MAJOR CONVERSE, U. S. A., CAPTAIN SMALL, U. S. A.,
SERGEANTS MADDEN AND O'ROURKE, MR. BRUDER

In accordance with the Morrill Act, passed in 1862, under which the University was established, military instruction must be included in the curriculum. The Board of Trustees therefore requires all male students, both special and regular, *unless excused by the Military and Gymnasium Board*, to drill during two years. Under ordinary circumstances this work is under three commissioned officers of the regular army, detailed for the purpose. The Military Department offers instruction during four days each week throughout the year.

1. Military Drill. One credit hour. Five months, three hours each week, (divided between fall and spring) military drill; four months, three hours each week, (winter) of class-room instruction in drill regulations. Target practice at any open hour during the after noon of the winter months, at 100, 200, and 300 yards. Lecture, one hour each week, by the President, upon topics of common interest to the student body.

2. **Military Drill.** One credit hour. Five months, three hours each week, (divided between fall and spring) in extended order and guard duty; four months, three hours each week (winter) of classroom instruction in Articles of War, guard manual, and field service regulations; target practice, at any open hour of the afternoon of the winter months, at 500, 600, and 800 yards.

MINE ENGINEERING

Office, 200 Lord Hall

PROFESSOR RAY, ASSISTANT PROFESSOR NOLD

101. Mine Engineering. Five credit hours. First semester. Lectures and field practice. Short Course in Mining, second year. Prerequisite, Mathematics 114. Mr. Nold.

This course is similar to Mine Engineering 103, but more elementary. The same text is used. The students have more practice in the drawing room.

102. Mine Engineering. Five credit hours. Second semester. Short Course in Mining, second year. Prerequisites, Mine Engineering 101, Physics 101. Mr. Nold.

Lectures illustrated by experiments, and maps of mines and models when possible; tests by safety lamps and anemometers; methods of air distribution in coal mines.

103. Mine Surveying. Four credit hours. First semester Mine Engineering, second year; Ceramic Engineering, third year. Prerequisites, Engineering Drawing 102, Mathematics 132. Mr. Ray, Mr. Nold.

Field practice in the use of instruments for surface and underground surveys. Field notes are taken and maps and plans made in the drawing room.

104. Plans and Specifications. Four credit hours. Second semester. Mine Engineering, fourth year. Prerequisite, Mine Engineering 105, Metallurgy 111. Mr. Ray, Mr. Nold.

Practice in designing mine plants, drafting, and estimating.

105-106. Mine Engineering. Five credit hours. The year.

Mine Engineering, fourth year. Prerequisites, Mechanics 102, Mine Engineering 103, Geology 165. Mr. Ray.

Lectures on mine operating, mining machinery, ventilation, shaft sinking, working out deposits, etc. Constant reference is required to standard works and to the leading technical journals.

107. Mine Engineering. Two credit hours. First semester. Four laboratory hours each week. Short Mining, second year. Concurrent, Mine Engineering 101. Mr. Nold.

109-110. Mine Trip. One credit hour. The year. Prerequisite, Mine Engineering 103, or equivalent. Mr. Nold.

117. Mining Problems. Two credit hours. First semester. Two recitations each week. Mine Engineering, third year. Prerequisites, Mine Engineering 103, 109, or 110. Mr. Nold.

Practice in the solution of engineering problems pertaining to mine projections, shafts, slopes, drifts for coal and metal mining.

120. Ventilation Control and Safety Appliances. Two credit hours. Second semester. Mine Engineering, fourth year, alternate with Metallurgy 120. Two afternoons each week, first two thirds of second semester. Prerequisites, Metallurgy 112 and Mine Engineering 105. Mr. Nold.

Laboratory work on mine illumination, ventilation and the use of safety appliances.

116. Thesis. Three credit hours. Second semester. Mr. Ray, Mr. Nold.

FOR GRADUATES

201-202. Research Work.

For description of graduate courses in this department see the Bulletin of the Graduate School.

MINERALOGY

Office, 104 Lord Hall

PROFESSOR MCCAUGHEY

102. Crystallography and Mineralogy. Three credit hours. Either semester. Mine Engineering, second year; Chemical Engineering, third year; Pharmacy, fourth year. Prerequisite, Chemistry 106 or 110.

Lectures on crystallography, physical and descriptive mineralogy. Illustrated by drawings, models, and mineral specimens.

104. Determinative Mineralogy. Three credit hours. Second semester. One lecture, six laboratory hours each week. Mine Engineering, third year. Prerequisite, Mineralogy 102.

Lectures and laboratory work in practical determination of minerals by physical and chemical tests. Each student is furnished with a set of apparatus and works under an instructor's inspection. Brush and Penfield's "Determinative Mineralogy" is used as a manual.

105. Physical Chemical Mineralogy. Two credit hours. First semester. Ceramic Engineering, fourth year. Prerequisites, Chemistry 159, Ceramic Engineering 108. Mr. McCaughey.

Thermal properties of minerals, their formation and transformation in silicate mixtures.

121. Microscopic Mineralogy. Three to five credit hours. First semester. One lecture and four to eight laboratory hours each week. Prerequisites, Mineralogy 102 and Physics 114.

The use of the polarizing microscope in the identification of minerals in fine powder and in thin section. Determination of the optical constants of minerals and crystallized bodies with the polarizing microscope.

123-124. Microscopic Petrography. Five credit hours. The year. Elective. One lecture each week, four two-hour laboratory periods. Prerequisites, Mineralogy 102, Geology 165, 166. Mr. McCaughey.

Optical mineralogy. The determination and study of rock-forming minerals and rocks in hand specimen and thin section. The mineralogical and chemical composition of igneous and metamorphic rocks.

126. Advanced Crystallography and Physical Mineralogy. Three credit hours. Second semester. Two lectures and three laboratory hours each week. Prerequisites, Physics 114, Mineralogy 102.

The study of the geometrical and physical properties of crystals. Laboratory work on the measurement, calculation, and projection of crystals and the determination of the physical and optical constants of crystallized bodies.

PHYSICAL EDUCATION

Office, The Gymnasium

PROFESSORS ST. JOHN, WILCE, CASTLEMAN, AND NICHOLS,
MR. OHLSON, MR. TRAUTMAN, MR. BIRD

101-102. Physical Education. One credit hour. The year. Two hours each week. Required of all first-year students. During the first semester the course consists of one lecture on personal hygiene and one period of active physical exercise each week.

Personal Hygiene: Lectures and quizzes on the cause, prevention, and hygienic treatment of the common preventable diseases and conditions which lower the vitality and interfere with the health and efficiency of the students.

Physical Exercise in Class: A graded course of free-hand exercises, with light hand apparatus for the relief and correction of slight bodily defects, improper carriage, etc. Progressive exercises on the apparatus and mats, to promote muscular tone, organic vigor, bodily skill, etc. Dancing, gymnastic and athletic games and contests.

PHYSICS

Office, 107 Physics Building

PROFESSORS COLE, EARHART, BLAKE, BARNETT, SHEARD
AND ALPHEUS W. SMITH, ASSISTANT PROFESSOR HEIL,
MR. WOODBURY, MR. ALVA W. SMITH, MR. DITTO,
AND DEPARTMENT ASSISTANTS

101. Elementary Physics. Six credit hours. First semester. Five recitations and lectures, and three laboratory hours each week. Short Clayworking, second year. Text-book, Millikan and Gale's Elements of Physics.

111. General Physics. Three credit hours. First semester. Two lectures, one recitation and two laboratory hours each week. Architectural, Ceramic, Chemical, Civil, and Mine Engineering, second year. Prerequisite, entrance physics and Mathematics 132. All instructors.

112. General Physics. Three credit hours. Second semester. Two recitations and two laboratory hours each week. Ceramic, Chemical and Mine Engineering, second year. Prerequisite, Physics 111.

A continuation of Physics 111.

113. General Physics. Five credit hours. First semester. Electrical Engineering, three recitations and two problem periods each week; Mechanical Engineering, two recitations, two problem periods and two laboratory hours each week. Electrical and Mechanical Engineering, second year. Prerequisite, elementary physics and Mathematics 132. All instructors.

Mechanics and heat.

114. General Physics. Four credit hours. Second semester. Two recitations on general text and two on problems each week. Electrical Engineering, second year. Prerequisite, Physics 113. Mr. Heil, Mr Smith.

117. General Physics. Two credit hours. First semester. Two recitations each week in mechanics, acoustics and heat with demonstrations. Architecture, second year. Prerequisite, entrance physics and Mathematics 132.

118. General Physics. Two credit hours. Second semester. Two recitations each week in electricity and light with demonstrations. Architecture, second year. Prerequisite, Physics 117.

119. General Physics. Three credit hours. Second semester Three recitations each week. Mechanical Engineering, second year. Prerequisite, Physics 113. Mr. Cole, Mr. Woodbury.

125. General Physics. Five credit hours. Second semester. Three lectures and recitations on text, one hour of problem drill and one two-hour laboratory period each week. Civil Engineering, second year. Prerequisite, Physics 111. Mr. Earhart, Mr. Smith, and department assistants.

133. Physical Laboratory. Two credit hours. First semester. Four laboratory hours each week. Electrical Engineering, second year. Concurrent, Physics 113. Mr. Smith, Mr. Heil.

134. Electrical Measurements. Four credit hours. Second semester. One recitation and six hours laboratory work each week. Electrical Engineering, second year. Concurrent, Physics 114. Mr. Barnett.

135. Electrical Measurements and Photometry. Five credit hours. First semester. Nine laboratory hours each week. A continuation of Physics 134. Electrical Engineering, third year. Prerequisites, Physics 114 and 134, Mathematics 141-142. Mr. Barnett.

136. Physical Laboratory. Four credit hours. Second semester. Six laboratory hours each week, in electrical measurements; two laboratory hours each week, in mechanics and heat experiments. General Engineering, second year. Concurrent, Physics 114 and Mathematics 142. Mr. Barnett.

137. Physical Laboratory. Three to five credit hours. First semester. Prerequisite or concurrent, Physics 111. Elective.

138. Physical Laboratory. Two credit hours. Second semester. Four laboratory hours each week. Mechanical Engineering, second year. Prerequisite, Physics 111; concurrent, Physics 112. Elective, three to five credit hours. Mr. Smith, Mr. Heil.

139-140. Advanced Electrical Measurements. Three to five credit hours. The course may be elected either semester. Prerequisite, Physics 135 or equivalent. Mr. Barnett.

This course is subject to considerable variation to meet the needs of individual students, but a large amount of time is always devoted to oscillography work.

123-124. Advanced Laboratory. Three to five credit hours. The year. Prerequisite, Physics 121-122. Mr. Smith.

144. Electricity. Three credit hours. Second semester. Prerequisite, Physics 103-104 or 105-106; calculus should precede or accompany. Mr. Earhart.

FOR GRADUATES

201-202. Research Laboratory.

***203-204. Theoretical Mechanics.**

***205-206. Thermodynamics and Electrolytic Conduction.**

207-208. Theory of Electricity and Magnetism.

***211-212. Theory of Oscillations with Applications to Wireless Telegraphy.**

***213-214. Conduction of Electricity Through Gases and Radioactivity.**

215-216. Electromagnetic Theory.

For description of graduate courses in this department see the Bulletin of the Graduate School.

---

*Not given in 1918-1919.

ROMANCE LANGUAGES AND LITERATURES

Office, 305 University Hall

PROFESSORS BOWEN, BRUCE, AND INGRAHAM, ASSISTANT PROFESSORS HAMILTON, CHAPIN, AND PEIRCE, MR. CARDON, MR. GUIGOU, MR. GUTIERREZ, MR. RILEY, MR. BERTHEMY, AND DEPARTMENT ASSISTANTS

FRENCH

101-102. Elementary French. Four credit hours. The year. Four recitations each week. May be taken by students in any four-year course who enter with no entrance credits in French. Text-books: Fraser and Squair's Grammar, or equivalent, and Aldrich and Foster's or Bowen's First Scientific Reader. Historical and narrative prose; one or more prose comedies.

French 101 is given also during the second semester.

French 102 is given also during the first semester.

103. Modern French Literature. Four credit hours. First semester. Four recitations each week. May be taken by first-year students in any four-year course who enter with two units entrance credit in French. Prerequisite, French 101-102, or two entrance credits.

The work of the year deals with the following subjects: (1) Contes; (2) The novel (Balzac or Hugo); (3) Lyric poetry; (4) Romantic drama (Hugo). Prose composition, with practice in speaking. Systematic attention given to syntax and idiom. Lectures supplement the work. Private reading required.

French 103 is given also during the second semester.

106. Science Reading. Four credit hours. Second semester. Four recitations each week. Must be taken by students in Engineering who take French 103 during the first semester.

A course of rapid reading introductory to the vocabulary of scientific literature.

SPANISH

101-102. Elementary Spanish. Four credit hours. The year. Four recitations each week. May be taken by students in any four-year course who enter with no entrance credit in Spanish. Text-books: Ingraham-Edgren's grammar, or equivalent, and Ingraham's Victoria y Otros Cuentos.

Easy prose and plays. Composition and practice in speaking.

Spanish 101 is given also during the second semester.

103-104. Modern Spanish Literature. Four credit hours. The year. Four recitations each week. May be taken by students who enter with two units entrance credit in Spanish. Prerequisite, Spanish 101-102, or two units entrance credit.

The modern novel and drama. Lectures covering a survey of the literature. Composition and practice in speaking continued.

110. Commercial Reading and Correspondence. Four credit hours. Second semester. Prerequisite, Spanish 103. Mr. Chapin.

A course designed to familiarize students with the vocabulary of business and with the forms of Spanish commercial paper and correspondence.

SHOPWORK

Office, 125 Shop Building

PROFESSOR SANBORN, ASSOCIATE PROFESSOR W. A. KNIGHT,
MR. CASE, MR. BEEM, MR. FOUST, MR. DENMAN, MR.
BRECKUR, AND DEPARTMENT ASSISTANTS

For courses in Industrial Arts see page 60

105. Foundry Work. Two credit hours. Either semester. One recitation and four laboratory hours each week. Mechanical Engineering, second year. Mr. Beem, Mr. Breckur.

Exercises and practice on tempering sand and preparing molds of machine parts in sand, core-making, melting iron and brass, and pouring.

107. Chipping and Filing. Two credit hours. Either semester. One recitation and four laboratory hours each week. Mechanical Engineering, second year. Ceramic Engineering alternative with 109 and 115, Summer Session. Mr. Case.

Exercises and practice in vise work including chipping in cast and wrought iron, surface filing, squaring, fitting, finishing, the scraping of surface plates, soldering and brazing.

109. Joinery and Pattern-Making. Two credit hours. Either semester. One recitation and four laboratory hours each week. Ceramic Engineering alternative with Shopwork 107 and 115. Chemical Engineering, Electrical Engineering, Mechanical Engineering, and Mine Engineering, during the Summer Session at the close of the first year. Mr. Beem, Mr. Denman, Mr. Smith.

Exercises and practice in joinery, wood-turning, and pattern-making, including sawing, planing, mortising, framing, and other work involving the use of the ordinary carpenter tools, center and chuck-turning, and making of finished patterns.

111. Advanced Pattern-Making. One credit hour. Either semester. Three laboratory hours each week. Mechanical Engineering second year. Prerequisite, Shopwork 109. Mr. Beem, Mr. Denman, Mr. Smith.

113. Cabinet Making. Two credit hours. Either semester. Six laboratory hours each week. Elective. Prerequisite, Shopwork 109. Mr. Beem, Mr. Denman, Mr. Smith.

Exercises and practice in cabinet-making, including paneling, mitre and dove-tail joints; use of power tools.

115. Forging. Two credit hours. Either semester. One recitation and four laboratory hours each week. Ceramic, Chemical, Electrical, Mechanical and Mine Engineering during the Summer Session at the close of the first year. Mr. Foust, Mr. Wright.

The use and care of forge, fire, and tools. Practice in iron and steel forging, including such operations as cutting, bending, drawing, upsetting, shaping, and welding iron; the making, hardening, and tempering of steel punches, chisels, and lathe tools.

118. Advanced Forging. Two credit hours. Second semester. Six laboratory hours each week. Elective. Prerequisite, Shopwork 115. Mr. Foust, Mr. Wright.

Various forms of welds in iron and steel; the use of scrolling irons and of forms for duplicating work; annealing; tool-making, case-hardening; tempering drills, dies, and cutters; spring-making; ornamental iron work; visits to shops.

119. Machine Work. Three credit hours. Either semester. One recitation and six laboratory hours each week. Electrical and Mechanical Engineering and Short Industrial Arts, second year. Mr. Knight, Mr. Case.

Elementary exercises on engine lathe, such as plain, straight and taper turning, screw cutting, chucking; boring, filing, and polishing, and the use of the drill press.

121. Advanced Machine Work. Three credit hours. Either semester. One recitation and six laboratory hours each week. Mechanical Engineering, third year. Electrical Engineering and Short Industrial Arts, second year. Prerequisite, Shopwork 119. Mr. Knight, Mr. Case.

A continuation of Shopwork 119 with more difficult exercises on the lathe, including square thread cutting, drilling, and tapping, use of steady rest, face-plate work, and bar turning. Also practice on the milling machines, planer, shaper and turret lathe.

123. Advanced Machine Work. Two credit hours. First semester. Six laboratory hours each week. Elective. Prerequisite, Shopwork 121. Mr. Knight, Mr. Case.

A more advanced course in milling machine work and grinding. Exercises in spur and spiral gear cutting, cam cutting, and differential and fractional indexing.

125. Construction Work. Two credit hours. Either semester. Six laboratory hours each week. Elective. Prerequisite, Shopwork 121. Mr. Knight, Mr. Case.

A course in construction work on any piece of apparatus or machinery which may be in course of construction in the shops.

127. Tool-Making and Jig Work. Three credit hours. Either semester. Elective. Prerequisite, Shopwork 123. Mr. Knight, Mr. Case.

130. Advanced Pattern-Making. Three hours credit. Second semester. Short Industrial Arts.

FOR GRADUATES

201-202. Research Work.

For description of graduate courses in this department see the Bulletin of the Graduate School.

SPANISH

(See Romance Languages)

The Ohio State University Bulletin is published at least twenty times during the year as follows: Monthly in June, July, August, and September, and bi-weekly in October, November, December, January, February, March, April, and May.

PRESS OHIO STATE REFORMATORY

The Ohio State University Bulletin

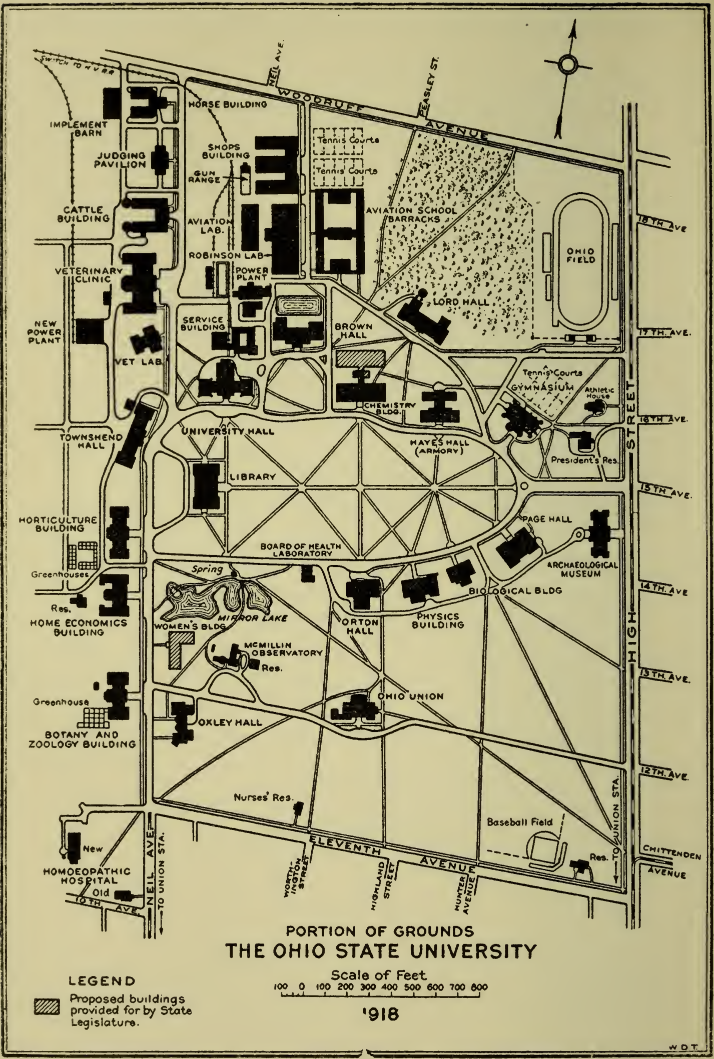
VOLUME XXIII MARCH, 1919 NUMBER 21

COLLEGE OF ENGINEERING

1919-1920

PUBLISHED BY THE UNIVERSITY AT COLUMBUS

Entered as second-class matter November 17, 1905, at the Post Office at Columbus, Ohio, under Act of Congress, July 16, 1894. Acceptance for mailing at special rate of postage provided for in Sectoin 1103, Act of October 3, 1917, Authorized July 10, 1918.



PORTION OF GROUNDS

THE OHIO STATE UNIVERSITY

1918

1 ENG

CALENDAR 1919

JANUARY

S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

FEBRUARY

S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	

MARCH

S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

APRIL

S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

MAY

S	M	T	W	T	F	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

JUNE

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					

JULY

S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

AUGUST

S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

SEPTEMBER

S	M	T	W	T	F	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

OCTOBER

S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

NOVEMBER

S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30						

DECEMBER

S	M	T	W	T	F	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

CALENDAR 1920

JANUARY

S	M	T	W	T	F	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

FEBRUARY

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29						

MARCH

S	M	T	W	T	F	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

APRIL

S	M	T	W	T	F	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	

MAY

S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

JUNE

S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

JULY

S	M	T	W	T	F	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

AUGUST

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

SEPTEMBER

	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

OCTOBER

S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

NOVEMBER

S	M	T	W	T	F	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

DECEMBER

S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

UNIVERSITY CALENDAR

1919

Summer Session, Monday, June 23 to Friday, August 15.

Entrance examinations, Tuesday to Saturday, June 24 to 28, 8 A. M.

Entrance examinations, Tuesday to Saturday, September 9 to 13, 8 A. M.

Registration Day—First Semester—Tuesday, September 16.

President's Annual Address, Wednesday, September 17, 11 A. M.

Latest date for registration of candidates for a degree at the Commencement in June 1920, October 1.

Registration Day, Short Courses in Agriculture—First Term—Tuesday, October 14.

Mid-semester reports to the Deans concerning delinquent students, Wednesday, November 19.

Thanksgiving recess begins November 26, 1 P. M., and ends December 2, 8 A. M.

Christmas recess begins Friday, December 19, 6 P. M.

1920

Christmas recess ends Tuesday, January 6, 8 A. M.

Registration Day, Short Courses in Agriculture—Second Term—Tuesday, January 6.

Final examinations, Wednesday, January 21 to Thursday, January 29.

Farmers' Week, Monday, January 26 to Friday, January 30.

First semester ends Thursday, January 29, 6 P. M.

Registration Day—Second Semester—Tuesday, February 3.

University Day, Saturday, February 21.

Close of Second Term, Short Courses in Agriculture, Friday, March 12.

Mid-semester reports to the Deans, Saturday, March 21.

Easter recess, Thursday noon, April 1 to Tuesday, April 6, 8 A. M.

Competitive Drill—Cadet Regiment—Saturday, May 29.

Memorial Day, Sunday, May 30.

Final examinations, Wednesday, June 3 to Thursday, June 10.

Commencement, Tuesday, June 15.

Summer Session, Monday, June 21 to Friday, August 13.

Entrance examinations, Tuesday, June 22 to Saturday, June 26, 8 A. M.

ADMINISTRATION

BOARD OF TRUSTEES

Frank E. Pomerene	Coshocton
Benjamin F. McCann	Dayton
John F. Cunningham	Cleveland
John Kaiser	Marietta
Charles F. Kettering	Dayton
Guy W. Mallon	Cincinnati
Oscar E. Bradfute	Xenia

ADMINISTRATIVE OFFICERS

President .... William Oxley Thompson
Office: University Hall—99312; N. 476
Residence: University Grounds—2056

Secretary of the Board of Trustees and Business Manager .... Carl E. Steeb
Office: University Hall (East End)—99332; N. 32
Residence: 1956 Iuka Ave.—5835

Registrar, University Editor and Secretary of the University Faculty .... Edith D. Cockins
Office: 101 University Hall—99314
Residence: 1348 Neil Ave.—16310

Secretary of the Entrance Board .... Lester E. Wolfe
Office: 107 University Hall—99353; N. 939
Residence: 1491 Neil Ave.—16507

Executive Clerk .... Katherine A. Vogel
Office: University Hall—99312; N. 476
Residence: 209 S. Monroe Ave.—E. 2356

Cashier .... Bess C. Watters
Office: University Hall (East End)—99332; N. 32
Residence: 1851 N. Fourth St.—N. 2108

COLLEGE OF ENGINEERING

Acting Dean .... Edwin F. Coddington
Office: 131 Lord Hall—99331
Residence: Roxbury and Chelsea Roads, Upper Arlington

Secretary .... Robert Meiklejohn
Office: 131 Lord Hall—99331
Residence: 419 W. Ninth Ave.—16286

THE TEACHING STAFF

PROFESSORS

Rosser Daniel Bohannan, B. Sc., C. E., E. M. ....226 Sixteenth Avenue
Professor of Mathematics

Benjamin Lester Bowen, Ph. D., Litt. D...775 East Broad Street
Professor of Romance Languages and Literatures

Joseph Villiers Denney, M. A............230 West Tenth Avenue
Professor of English and Dean of the College of Arts, Philosophy and Science

*Edward Orton, Jr., E. M. ....629 East Broad Street
Research Professor of Ceramic Engineering

William Thomas Magruder, M. E......342 West Ninth Avenue
Professor of Mechanical Engineering

**William McPherson, M. Sc., D. Sc., Ph. D. ....198 Sixteenth Avenue
Professor of Chemistry and Dean of the Graduate School

Joseph Nelson Bradford, M. E. ....1778 North High Street
Professor of Architecture and University Architect

Henry Curwen Lord, B. Sc. ....University Campus
Professor of Astronomy and Director of the Emerson McMillen Observatory

*Frank Edwin Sanborn, S. B. in M. E....90 Fourteenth Avenue
Professor of Industrial Arts and Director of the Department

*Frank Arnold Ray, E. M...........431 Citizens' Bank Building
Professor of Mine Engineering

Francis Cary Caldwell, B. A., M. E.......206 Sixteenth Avenue
Professor of Electrical Engineering

John Adams Bownocker, D. Sc. ....185 Fifteenth Avenue
Professor of Inorganic Geology and State Geologist of Ohio

Alfred Dodge Cole, M. A. ....1648 Neil Avenue
Professor of Physics

Christopher Elias Sherman, C. E........141 Thirteenth Avenue
Professor of Civil Engineering

Frank Harvey Eno, B. Sc., C. E..........222 Sixteenth Avenue
Professor of Municipal Engineering

---

*Absent on leave 1918-1919.

**Absent on leave until March 25, 1919.

James Ellsworth Boyd, M. Sc. ......188 East Frambes Avenue
Professor of Mechanics

Thomas Ewing French, M. E..........1458 Worthington Street
Professor of Engineering Drawing

George Washington McCoard, M. A..........1474 Neil Avenue
Professor of Mathematics

William Edwards Henderson, Ph. D......214 Sixteenth Avenue
Professor of Inorganic and Physical Chemistry

Charles William Foulk, B. A.................384 King Avenue
Professor of Analytical Chemistry

Karl Dale Swartzel, M. Sc..................1952 Iuka Avenue
Professor of Mathematics

Harry Waldo Kuhn, Ph. D. ....
...................1145 Fairview Ave., Grandview Heights
Professor of Mathematics

Clyde Tucker Morris, C. E. ....2043 Iuka Avenue
Professor of Structural Engineering

**Edward Elsworth Somermeier, G. Ph........41 King Avenue
Professor of Metallurgy

†William Lloyd Evans, M. Sc., Ph. D.....................
............................81 South Champion Avenue
Professor of Chemistry

Marshall Blakemore Evans, Ph. D..........38 Twelfth Avenue
Professor of German

*Alan Estis Flowers, M. E. in E. E., M. M. E., Ph. D.......
....1634 Neil Avenue
Professor of Electrical Engineering

Edwin F. Coddington, C. E., M. Sc., Ph. D................
............Roxbury and Chelsea Roads, Upper Arlington
Professor of Mechanics and Acting Dean of the College of Engineering

Robert F. Earhart, Ph. D.............371 West Tenth Avenue
Professor of Physics

---

*Absent on leave 1918-1919.

**Died March 26, 1919.

†Absent on leave, first semester 1918-1919.

James Renwick Withrow, B. Sc. (Chem.), Ph. D...........
.................................77 Sixteenth Avenue
Professor of Chemistry

*Berthold August Eisenlohr, M. A..........................
Professor of German

†Frederic Columbus Blake, Ph. D............2107 Iuka Avenue
Professor of Physics

Edgar Schugert Ingraham, Ph. D....182 East North Broadway
Professor of Romance Languages

Samuel Eugene Rasor, M. A., M. Sc..........1594 Neil Avenue
Professor of Mathematics

Charles St. John Chubb, Jr., C. E. (Arch.)...............
..............................237 Seventeenth Avenue
Professor of Architecture

†Dana James Demorest, B. Sc. in Ch. E.......................
Professor of Metallurgy

*Franklin Wales Marquis, B. Sc. in M. E., M. E...........
..............................412 West Eighth Avenue
Professor of Steam Engineering

Lynn Wilbur St. John, B. Ph..............168 Twelfth Avenue
Professor of Physical Education

John Woodworth Wilce, B. A...............70 Twelfth Avenue
Professor of Physical Education

Frank Riley Castleman, B. Sc. ......161 East Frambes Avenue
Professor of Physical Education

Arthur S. Watts ....1764 North High Street
Professor of Ceramic Engineering

Charles C. Morris, M. A................207 Thirteenth Avenue
Professor of Mathematics

Charles Fabens Kelley, B. A..............1951 Summit Street
Professor of Art

William John McCaughey, B. Sc. (Chem.), Ph. D..........
..............................108 East Frambes Avenue
Professor of Mineralogy

---

*Absent on leave 1918-1919.
†Absent on leave, first semester 1918-1919.

Alpheus Wilson Smith, M. A., Ph. D......306 Sixteenth Avenue
Professor of Physics

*J. Ernest Carman, Ph. D. ....
Professor of Geology

*John Herbert Nichols, B. A., M. D...........................
Professor of Physical Education

Carl A. Norman, M. E............205 East Northwood Avenue
Professor of Machine Design

Howard Dwight Smith, C. E. in Arch., B. Arch............
..........................Devon Road, Upper Arlington
Professor of Architecture

Morris Morgan Leighton, Ph. D..........3 Fourteenth Avenue
Professor of Historical Geology

Charles Allen Wright, B. E., E. E., M. E. E...............
...................................2051 Waldeck Avenue
Professor of Electrical Engineering

Charles F. Leonard, Lieutenant Colonel, U. S. A...........
...................................1013 Franklin Avenue
Professor of Military Science and Tactics

ASSOCIATE PROFESSORS

Charles Lincoln Arnold, M. Sc........328 West Eighth Avenue
Associate Professor of Mathematics
William Abner Knight, M. E...........206 West Lane Avenue
Associate Professor of Machine Shop Practice

Horace Judd, M. E., M. Sc. ....281 Thirteenth Avenue
Associate Professor of Hydraulic Engineering

*Edmund Sewall Manson, Jr., M. Sc. ....
Associate Professor of Astronomy

ASSISTANT PROFESSORS

John Bowker Preston, M. A..............290 Fifteenth Avenue
Assistant Professor of Mathematics

Robert Meiklejohn, M. E. ....419 West Ninth Avenue
Assistant Professor of Engineering Drawing

---

*Absent on leave 1918-1919.

May Thomas, Ph. D................233 West Eleventh Avenue
Assistant Professor of German

Grace Bareis, Ph. D. ....201 West Eleventh Avenue
Assistant Professor of Mathematics

Theodore Ely Hamilton, M. A., Ph. D........319 King Avenue
Assistant Professor of Romance Languages

*Sarah Tracy Barrows, M. L..........1806 North High Street
Assistant Professor of German

Edwin Long Beck, B. A. ....2651 Summit Street
Assistant Professor of English

Thomas McDougal Hills, B. Ph. ....1942 Iuka Avenue
Assistant Professor of Geology

Robert Oscar Busey, M. A..................2090 Iuka Avenue
Assistant Professor of German

George S. Chapin, M. A..............321 Seventeenth Avenue
Assistant Professor of Romance Languages

Carl B. Harrop, E. M. ....2326 Indianola Avenue
Assistant Professor of Ceramic Engineering

Cecil E. Boord, M. A., Ph. D............417 Thirteenth Avenue
Assistant Professor of Chemistry

*Walter Peirce, M. A., Ph. D. ....
Assistant Professor of Romance Languages

Owen E. Williams ....2094 Tuller Street
Assistant Professor of Engineering Drawing

*Clarence E. Andrews, Ph. D...............................
Assistant Professor of English

Milton Percival, Ph. D...................1904 Summit Street
Assistant Professor of English

Roscoe C. Sloane, B. Ph., C. E. ....205 Thirteenth Avenue
Assistant Professor of Civil Engineering

William D. Turnbull, C. E. ....151 East Oakland Avenue
Assistant Professor of Engineering Drawing

---

*Absent on leave 1918-1919.

Harry E. Nold, E. M. ....27 West Blake Avenue
Assistant Professor of Mine Engineering

Carl L. Svensen, B. Sc. ....74 Euclid Avenue
Assistant Professor of Engineering Drawing

Herman G. Heil, B. Ph.................323 West Ninth Avenue
Assistant Professor of Physics

Hewitt Wilson, Cer. E. ....127 Twelfth Avenue
Assistant Professor of Ceramic Engineering

William Motier Tucker, Ph. D. ....55 East Norwich Avenue
Assistant Professor of Geology

Jesse Erwin Day, Ph. D. ....1484 Belmont Avenue
Assistant Professor of Chemistry

Stephen C. Guigou, B. A. ....Central Y. M. C. A.
Assistant Professor of Romance Languages

Jacob Ralph Shank, B. Sc. ....97 West Tompkins Street
Assistant Professor of Civil Engineering

Aubrey Ingerson Brown, M. E.......412 West Eighth Avenue
Assistant Professor of Steam Engineering

Emil F. Hacker ....161 East Frambes Avenue
Assistant Professor of Romance Languages

J. Charles Rietz, B. A. ....197 Tulane Road
Assistant Professor of Mathematics

*George M. Trautman, B. Sc. (For.)....13 Seventeenth Avenue
Assistant Professor of Physical Education

Griffin Halstead, Captain Ordnance, U. S. A. ....
.................................90 Fourteenth Avenue
Assistant Professor of Military Science and Tactics

INSTRUCTORS

Frank H. Haskett ....380 King Avenue
Instructor in Architecture

*Wilbert C. Ronan, C. E. (Arch.), B. Sc. (Arch.).........
...................................47 Twelfth Avenue
Instructor in Architecture

---

*Absent on leave, first semester 1918-1919.

William J. Norris ....60 East Eighth Avenue
Instructor in Art

Homer Burton Adkins, Ph. D............66 Chittenden Avenue
Instructor in Chemistry

Marion Hollingsworth, M. A. ....1562 Worthington Street
Instructor in Chemistry

Frank Carl Vilbrandt, M. A. ....170 West Frambes Avenue
Instructor in Chemistry

Melvin Guy Mellon, M. Sc. ....189 West Eleventh Avenue
Instructor in Chemistry

Ora Loring Hoover, B. A...............35 West Ninth Avenue
Instructor in Chemistry

Edward Marquis Starr, B. A...........1052 West Broad Street
Instructor in Chemistry

Cloyd Delson Looker, B. Sc. ....20 Fourteenth Avenue
Instructor in Chemistry

Paul E. Marling, B. A. ....204 East Duncan Street
Instructor in Chemistry

Wilhelm Neilson, B. Sc. in C. E.........3028 North High Street
Instructor in Civil Engineering

Gabriel Weber, B. C. E..................1567 Highland Street
Instructor in Civil Engineering

John E. Shepardson, B. Sc. ....216 West Woodruff Avenue
Instructor in Electrical Engineering

Roy A. Brown, M. E. in E. E. ....2074 Peasley Street
Instructor in Electrical Engineering

Albert Frederick Puchstein, B. E. E...204 East Norwich Avenue
Instructor in Electrical Engineering

Wooster Bard Field, C. E. in Arch........22 East Lane Avenue
Instructor in Engineering Drawing

J. Forest Craig, M. A. ....191 Fifteenth Avenue
Instructor in English

Charles G. Dishong, B. Sc. (Edu.), M. A.................
..............................75 West Tenth Avenue
Instructor in English

Earl W. Wiley, M. A. ....438 King Avenue
Instructor in English

Gertrude L. Robinson, M. A. ....Worthington
Instructor in English

Louis Foley, M. A. ....16 Alhambra Court
Instructor in English

Verona Mae Dollinger, M. A...........1806 North High Street
Instructor in English

William Herman Gysan, M. A........................Dublin
Instructor in English

Arthur Charles Bevan, B. Sc........108 East Woodruff Avenue
Instructor in Geology

Helen Morningstar, M. A. ....1275 Franklin Avenue
Instructor in Geology

*Theodore F. Kotz, M. A. ....
Instructor in German

*Allando A. Case ....347 West Tenth Avenue
Instructor in Industrial Arts

Clement M. Beem ....17 University Place
Instructor in Industrial Arts

†Jacob A. Foust ....21 West Frambes Avenue
Instructor in Industrial Arts

Ulysses W. Denman ....22 West Maynard Avenue
Instructor in Industrial Arts

John J. Breckur.......................1133 Highland Street
Instructor in Industrial Arts

Perry Lisbon Wright ....89 West Lane Avenue
Instructor in Industrial Arts

J. Edwin Balmer ....128 West Woodruff Avenue
Instructor in Industrial Arts

Hortense Rickard, M. A. ....333 West Tenth Avenue
Instructor in Mathematics

James Henry Weaver, Ph. D......................Hilliards
Instructor in Mathematics

---

*Absent on leave 1918-1919.

†Absent on leave, first semester 1918-1919.

Harry M. Beatty, M. A. ....2359 Summit Street
Instructor in Mathematics

Paul Bucher, B. M. E. ....129 West Frambes Avenue
Instructor in Mechanical Engineering

Jasper O. Draffin, B. Sc. in C. E., M. Sc., 315 West Ninth Avenue
Instructor in Mechanics

*Earl C. Smith, E. M....................................
Instructor in Metallurgy

Henry C. Ohlson ....18 Seventeenth Avenue
Instructor in Physical Education

Ossian C. Bird, B. A..................2049 Waldeck Avenue
Instructor in Physical Education

Dwight A. Woodbury, M. Sc.......228 East Northwood Avenue
Instructor in Physics

Alva W. Smith, M. A..................1152 Grandview Avenue
Instructor in Physics

Raymond Clyde Ditto, M. A..........1450 Worthington Street
Instructor in Physics

Jerry Hall Service, M. Sc..............23 West Blake Avenue
Instructor in Physics

Santiago Gutierrez, M. A..................15 Indianola Court
Instructor in Romance Languages

Ernest S. Berthemy....................211 East State Street
Instructor in Romance Languages

Henri Tailliart, B. A..................162 Fourteenth Avenue
Instructor in Romance Languages

Bertha Peelle Arthur, M. A..............9 Chittenden Avenue
Instructor in Romance Languages

Ralph C. Williams, Ph. D..............323 West Ninth Avenue
Instructor in Romance Languages

Florence Hier, B. A................163 West Eleventh Avenue
Instructor in Romance Languages

Edward Hudson Young, M. A. ....6 Indianola Court
Instructor in Romance Languages

---

*Absent on leave 1918-1919.

ASSISTANTS

Jacob Cornog, B. A. ....1411 North Fifth Street
Assistant in Chemistry

John Mouk Ort, B. Ch. E.................2078 Peasley Street
Assistant in Chemistry

Elisabeth Park, B. A. ....869 Bryden Road
Assistant in Chemistry

James Garfield Ralston, B. Sc. ......116 West Frambes Avenue
Assistant in Chemistry

Alpha Jay Will, B. A.................1441 Worthington Street
Assistant in Chemistry

Floyd Marion Martin ....281 Dakota Avenue
Assistant in Engineering Drawing

Charlotte C. Wilkinson ....64 East Eleventh Avenue
Assistant in Engineering Drawing

Edith Mary Sniffen, M. A. ....185 West Eleventh Avenue
Assistant in English

Erwin Allen Esper, B. A...............1349 Dennison Avenue
Assistant in English

Harold R. Wright ....963 Sullivant Avenue
Assistant in Industrial Arts

Carl M. Senn ....1551 Worthington Street
Assistant in Industrial Arts

Charles H. Woodruff ....48 West Woodruff Avenue
Assistant in Industrial Arts

Joseph S. Gregorius ....253 Marshall Avenue
Assistant in Metallurgy

John S. Ward, B. Sc. ....164 West Ninth Avenue
Assistant in Physics

Della R. Maddox, B. A. ....1520 Highland Street
Assistant in Romance Languages

Emma Catherine Stubner, B. A. ....1981 Indianola Avenue
Assistant in Romance Languages

Gildo Masso ....151 West Tenth Avenue
Assistant in Romance Languages

THE OHIO STATE UNIVERSITY

The Ohio State University, located in Columbus, is a part of the public educational facilities maintained by the State.

ORGANIZATION

For convenience of administration, the departments of the University are grouped into organizations called colleges. The Ohio State University comprises eleven colleges and a graduate school, each under the administration of a Dean and College Faculty, as follows:

Graduate School
College of Agriculture
College of Arts, Philosophy and Science
College of Commerce and Journalism
College of Dentistry
College of Education
College of Engineering
College of Homœopathic Medicine
College of Law
College of Medicine
College of Pharmacy
College of Veterinary Medicine

SUMMER SESSION

In addition to the above, there is a Summer Session under the supervision of a Director and governing committee for the administration of the regular University courses offered in the summer.

This bulletin of announcements is devoted exclusively to the work of the College of Engineering, offered during the academic year beginning September, 1919.

(*Note*—The University publishes a bulletin descriptive of each college. Copies may be obtained by addressing L. E. Wolfe, Secretary of the Entrance Board, Ohio State University, Columbus, Ohio, and stating the college in which the writer is interested.)

THE COLLEGE OF ENGINEERING

The purpose of the College of Engineering is to instruct students in the fundamental sciences and arts, upon which all engineering rests, and to impart such special and technical knowledge of the various branches of engineering as will enable its graduates to enter them and maintain themselves while gaining their professional experience. To accomplish this purpose, the work of the College is classified under nine curricula, which are described on the following pages and which lead to the following degrees:

Bachelor of Architecture (B. Arch.)
Bachelor of Architectural Engineering (B. Arch. E.)
Bachelor of Ceramic Engineering (B. Cer. E.)
Bachelor of Chemical Engineering (B. Ch. E.)
Bachelor of Civil Engineering (B. C. E.)
Bachelor of Electrical Engineering (B. E. E.)
Bachelor of Mechanical Engineering (B. M. E.)
Bachelor of Engineering in Mining (B. E. M.)
Bachelor of Engineering (B. E.)

The curriculum leading to the degree of B. E. is offered for the benefit of those students who may desire instruction not included in any one of the special curricula, and also for those who may wish an opportunity to pursue a limited number of cultural studies, together with elective engineering studies. It is believed, however, that the severe mental discipline of any of these curricula makes the work of the College of Engineering the equal of any other in general educational value.

FIVE-YEAR CURRICULUM

For the benefit of those who are unable to carry the full schedule, on account of outside work for self-support, impaired health, or any other valid reason, any of the regular curricula can be rearranged to cover five instead of four years.

COMBINATION CURRICULA

It is also possible to arrange combination curricula leading to two degrees in five or more years. (See page 35.)

GRADUATE COURSES

Advanced courses in various engineering subjects are offered by the departments of the College of Engineering to those who wish to pursue them. If such courses are pursued with the expectation of receiving credit upon them to apply towards any higher degree, the student must register in the Graduate School, under whose jurisdiction all work for the higher degrees is conducted. For further information, consult the Bulletin of the Graduate School of the University or confer with the Dean or Secretary. (See page 36.)

SPECIAL STUDENT'S CERTIFICATE

A special certificate will be issued to any special student, completing a special course of not less than 60 credit hours, approved by the Dean and the head of the department in which the major portion of the student's work lies. The certificate will contain a statement of the subjects taken.

GENERAL INFORMATION

OFFICE HOURS OF THE SECRETARY OF THE COLLEGE

The office of the College of Engineering is in Room 131, Lord Hall. The office hours are 8 to 12 a. m. and 1:30 to 5 p. m. daily, except Saturday. Office hours Saturday, 8 to 12 m.

RESERVE OFFICERS TRAINING CORPS

Under the Defense Act of June 3rd, 1916, there was established at the Ohio State University a Reserve Officers Training Corps to which all students are eligible who have completed the requirements in Military Drill for the first and second years. Students entering the Reserve Officers Training Corps are required to complete a practical and theoretical course in Military Science extending through the Junior and Senior years of residence. When this requirement is completed the President of the United States will grant them a commission as 2nd Lieutenant in the Officers Reserve Corps when recommended by the Commandant of Cadets and the President of the University.

During this two years of required work the United States will furnish to the student one complete uniform each year and one ration which is commuted at 30 cents per day during the fiscal year. (See page 34.)

THESIS

As a requisite for graduation each candidate in the College of Engineering must present an acceptable thesis, embodying the results of a special study. The subject of this study must lie within the field of the degree sought. The subject must be filed with the head of the department, under whose direction the work is done, on the official blank provided for the purpose, not later than December 15th, of the University year in which the degree is sought. The completed thesis must be submitted to the professor who has directed the work not later than the second Thursday before Commencement Day for final approval.

If the thesis is then approved the student shall deposit two copies of it with the University Editor not later than noon of the Thursday before Commencement, and shall pay to the Editor a fee covering the cost of binding the same.

STILLMAN W. ROBINSON FELLOWSHIP

This fellowship endowed by Stillman W. Robinson, late Professor of Mechanical Engineering, for the encouragement of graduate research in Engineering, has a value of $500 annually and is open to graduates in Mechanical, Civil and Electrical Engineering.

The holder of this fellowship must devote his entire time to graduate work. This should lead to the Master's or the Doctor's degree under the general regulations which obtain in reference to these degrees. For further information or for application blanks address the Dean of the Graduate School or the Secretary of the College of Engineering. All applications should be filed with the Dean of the Graduate School not later than March 15th.

E. I. du PONT de NEMOURS FELLOWSHIP

Through the generosity of E. I. duPont de Nemours & Company of Wilmington, Delaware, and in recognition of the service of colleges and universities in training chemists for the emergency of the war, fellowships in chemistry have been established in a number of institutions, one of which is available at the Ohio State University.

The holder of the fellowship must be prepared to engage at once in active research upon a problem distinctly chemical in character, there being no further limitations upon the fellowship. The stipend is $750 per annum, and it is expected that at the conclusion of the year the holder of the fellowship will be able to present his research as a thesis for the degree of Doctor of Philosophy. The donors have not assumed obligation to continue the fellowship beyond the current year, but is hoped that it will be renewed.

FEES AND EXPENSES

All fees must be paid at the opening of each semester as a condition of admission to classes. Registration is not complete until the incidental and laboratory fees are paid.

Incidental Fee. The fee is fifteen dollars each semester.

Former students, who do not pay this fee until the third day of the first semester and second day of the second semester, must pay one dollar additional. For each day of delay thereafter, fifty cents is added.

Laboratory Deposit. Students are required to pay for all materials consumed in laboratory work. To meet the cost of these materials, a deposit for each course requiring such supplies, is made at the Bursar's office before the work is begun. In Chemistry the deposit is ten dollars. In other courses it varies with the amount of materials used. All laboratory supplies are sold at the General Store Room, Chemistry Hall, to students at about first cost to the University, and charged against the deposits. Any unused part of the deposits is refunded at the end of the semester.

Students should present their class-cards to the Bursar when they pay laboratory deposits.

OTHER EXPENSES

Locker Fee. The gymnasium is free to all students, but those desiring to use a locker are charged a fee of two dollars a semester, which includes the rental of towels.

Cadet Uniform. The uniform with which the members of the regiment are required to provide themselves costs (without overcoat) about twelve dollars. It is quiet in pattern and may be worn in place of civilian dress.

New students are advised against buying second-hand uniforms unless they have been previously inspected and approved by the Commandant. Inspection has shown in many cases that second-hand uniforms were unfit to wear and certainly not worth the price asked for them. All such uniforms are subject to rejection by the Commandant. Students should not arrange for uniforms until so directed by the military authorities.

Changes in Subjects or Schedule. Changes in subjects or schedule if made at the request of the student, shall be made only upon the payment of a fee of $1.00 for each change. The fee, in exceptional cases, may be remitted by the Executive Committee of the College.

Graduation Fee. A fee of five dollars, to cover expense of graduation and diploma, is required of each person receiving one of the ordinary degrees from the University, and this fee must be paid before the last Thursday preceding Commencement. A like fee of ten dollars is charged each person receiving one of the higher graduate degrees.

The Ohio Union. A fee of one dollar a semester is paid by all male students at registration. This entitles the student to all the privileges of the Union, consistent with the constitution and house rules governing it.

Text-books. Students should not purchase text-books until they are advised by the instructors of their respective classes.

EXPENSES PER YEAR

One of the most perplexing questions that confronts a prospective student is what the course is going to cost him a year.

In order to furnish information, we have listed below an estimate of the average payments required by the University for the freshman year in the College of Engineering, and have estimated the cost for room and boarding at a safe price. These two items are sometimes reduced slightly where two students occupy the same room and where boarding clubs are economically managed. Fees to the University are paid one-half at the beginning of each semester:

Incidental fee	$ 30 00
Ohio Union	2 00
Gymnasium locker	4 00
Deposits to cover laboratory materials and breakage	20 00
Drawing instruments and supplies	20 00
Uniform, gloves and shirt	15 00
Books	15 00
Board—36 weeks at $4.50 per week	162 00
Room rent, at $10.00 per month	90 00
General expenses	100 00
	$458 00

The item of general expenses is always subject to the personal habits of the individual, and varies according to the degree of economy exercised.

Note—In order to meet all the necessary expenses of registration, books, uniform, and other expenditures incident to securing a room and board, a student should come prepared to expend from $65.00 to $75.00 during the first ten days of a semester. After that period his board and room rent will constitute the major part of his expenses.

ADMISSION

The college is open on equal terms to both sexes. Applicants for admission must be at least seventeen years of age.

THE ENTRANCE BOARD

The admission of students to the University is in charge of the Entrance Board, which determines the credit that shall be issued on all entrance examinations and certificates, and furnishes all desired information to applicants. Correspondence relating to admission should be addressed to the Secretary of the Entrance Board, Ohio State University, Columbus, Ohio.

REQUIREMENTS

For complete entrance credit, an applicant for admission who is under twenty-one years of age, must be a graduate of a high school of the first grade and receive credit by certificate for fifteen units; or he must receive credit by examination for fifteen units.

Of these fifteen units, not less than three shall be in English; three in mathematics (including solid geometry); one in physics two in some one language (other than English); and six shall be elective, and may include any subject given by any first-grade high school.

Applicants under twenty-one years of age may be admitted to the college with a deficiency of one unit.

An applicant over twenty-one years of age may be admitted with a total deficiency of two units.

For admission by examination see page 28, by certificate see page 30 of the *Bulletin of General Information.*

REQUIREMENTS FOR ADMISSION AS A SPECIAL STUDENT UNDER TWENTY-ONE YEARS OF AGE

An applicant under twenty-one years of age who desires to pursue a special plan of work in the University, but who is not a candidate for a degree will be admitted as a special student upon the following conditions:

(a) He must satisfy the regular entrance requirements of the College of Engineering.

(b) He must submit to the Executive Committee of the college for approval a written statement of the end he has in view, the studies proposed for the attainment of that end, and the probable period of his residence at the University. He will be held as rigidly to his accepted scheme of work as are regular students to their prescribed course of study.

REQUIREMENTS FOR A SPECIAL STUDENT OVER TWENTY-ONE YEARS OF AGE

An applicant who is over twenty-one years of age and who is unable to meet the entrance requirements may be admitted as a special student by the Entrance Board provided he has first secured the approval of his proposed course of study by the Executive Committee of the college. But students who are admitted as special students cannot become candidates for a degree until they have satisfied all entrance requirements.

CURRICULA

OUTLINE OF THE FIRST YEAR'S WORK OF ALL FOUR-YEAR CURRICULA

In order to permit all engineering students to have a year in which to find out definitely what courses they desire to pursue, the first year of all engineering curricula except Architecture, is made uniform. While students are asked to indicate their choice on entering the College, they can change at the end of the first year without any inconvenience.

Note—The figure in parenthesis following the name of each study indicates the number of the study in its department, the other figure indicates the number of credit hours.

First Semester

Mathematics College Algebra and Trigonometry	(131)	5
Chemistry General Chemistry	(105 or 109)*	4
Modern Language French, German or Spanish		4
English Paragraph Writing	(101)	2
Engineering Drawing Elementary Mechanical	(101)	2
Physical Education		1
Military Drill		1

Second Semester

Mathematics Trigonometry and Analytics	(132)	5
Chemistry General Chemistry and Qualitative Analysis	(106 or 110)*	4
Modern Language French, German or Spanish		4
English Paragraph Writing	(104)	2
Engineering Drawing Lettering and Projections	(102)	3
Physical Education		1
Military Drill		1

SUMMER SESSION

Shopwork is required in the Summer Session in all Engineering curricula except Architecture and Civil Engineering. In Electrical, Mechanical, and Mine Engineering, the shopwork courses (109) and (115) are required at the end of the first year. In Chemical Engineering, the same courses are required, but may be taken at the end of the first or second year. In Ceramic Engineering and in General Engineering, Shopwork (107), (109), and (115) are offered and two of these must be taken at the end of the first year.

---

*Students presenting Chemistry as an entrance subject will take Chemistry 109 and 110. Students with no entrance credits in Chemistry will take Chemistry 105 and 106.

ARCHITECTURE

FIRST YEAR

FIRST SEMESTER			SECOND SEMESTER		
Mathematics College Algebra and Trigonometry	(131)	5	Mathematics Trigonometry and Analytics	(132)	5
French	(101 or 103)	4	French	(102 or 106)	4
English Paragraph Writing	(101)	2	English Paragraph Writing	(104)	2
Engineering Drawing Elementary Mechanical	(101)	2	Engineering Drawing Lettering and Projections	(102)	3
Art Elementary Drawing	(131)	2	Art Elementary Drawing	(132)	2
Architecture Elements of Architecture	(131)	2	Architecture Elements of Architecture	(132)	2
Physical Education		1	Physical Education		1
Military Drill		1	Military Drill		1

SECOND YEAR

Mathematics Calculus	(127)	3	Mathematics Calculus	(128)	3
Physics General Physics	(117)	2	Physics General Physics	(118)	2
Engineering Drawing Descriptive Geometry	(107)	3	Architecture Shades, Shadows and Perspective	(124)	3
Art Advanced Drawing	(133)	2	Art Elementary Design	(141)	2
Architecture History of Architecture	(133)	3	Architecture History of Architecture	(134)	3
Architecture Design	(141)	5	Architecture Design	(142)	5
Military Drill		1	Military Drill		1

SUMMER COURSE—Architecture (121), Architectural Practice, or an Architectural Problem. Four credit hours.

THIRD YEAR

Mechanics Statics and Strength of Materials	(103)	5	Civil Engineering Trusses	(124)	3
Art. Water Color	(136)	2	Art Advanced Water Color	(162)	2
Architecture Architectural Composition	(113)	2	Architecture Wood Construction	(150)	5
Architecture Photography	(111)	2	Architecture History of Architecture	(136)	3
Architecture History of Architecture	(135)	2	Architecture Design	(144)	5
Architecture Design	(143)	5			

SUMMER COURSE—Architecture (121), Architectural Practice, or an Architectural Problem. Four credit hours.

Fourth Year

First Semester			Second Semester		
Mechanical Engineering Heating and Ventilating	(121)	3	Civil Engineering Cement and Concrete	(130)	2
Architecture Plumbing	(117)	1	Architecture Professional Practice	(116)	4
Architecture Masonry	(151)	3	Architecture Thesis	(118)	5
Architecture Ornament	(147)	4	Architecture Design	(146)	5
Architecture Design	(145)	5	Art Drawing from Life	(164)	2
Art Drawing from Life	(163)	2			

For thesis requirements see page 16.

ARCHITECTURAL ENGINEERING

FOR FIRST YEAR, SEE PAGE 23

Second Year

Mathematics Calculus	(141)	5	Mathematics Calculus	(142)	5
Physics General Physics	(111)	3	Physics General Physics	(112)	3
Engineering Drawing Descriptive Geometry	(107)	3	Architecture Shades, Shadows and Perspective	(124)	3
Architecture Elements of Architecture	(131)	2	Architecture Elements of Architecture	(132)	2
Architecture History of Architecture	(133)	3	Architecture History of Architecture	(134)	3
Art Elementary Drawing	(131)	2	Art Elementary Drawing	(132)	2
Military Drill		1	Military Drill		1

Summer Course—Architecture (120), Architectural Practice, or an Architectural Problem. Four credit hours.

Third Year

Mechanics Statics and Strength of Materials	(103)	5	Mechanics Strength of Materials	(104)	2
Mechanical Engineering Materials of Construction	(123)	2	Civil Engineering Trusses	(124)	3
Architecture Architectural Composition	(113)	2	Architecture Photography	(111)	2
Architecture History of Architecture	(135)	2	Architecture Wood Construction	(150)	5
Architecture Design	(141)	5	Architecture Design	(142)	5
Electrical Engineering Illumination	(117)	2			

Summer Course—Architecture (121), Architectural Practice, or an Architectural Problem. Four credit hours.

FOURTH YEAR

FIRST SEMESTER			SECOND SEMESTER		
Mechanical Engineering Heating and Ventilating	(121)	3	Civil Engineering Cement and Concrete	(130)	2
Mechanical Engineering Experimental Engineering Laboratory	(169)	2	Civil Engineering Surveying	(128)	2
Architecture Plumbing	(153)	2	Architecture Professional Practice	(116)	4
Architecture Masonry	(151)	3	Architecture Thesis	(118)	5
Architecture Design	(143)	5	Architecture Fire Protection	(123)	2
Civil Engineering Tall Buildings	(125)	3	Civil Engineering Concrete Design	(129)	3

For thesis requirements see page 16.

CERAMIC ENGINEERING

FOR FIRST YEAR, SEE PAGE 23

SECOND YEAR

Mathematics Calculus	(141)	5	Mathematics Calculus	(142)	5
Physics Mechanics and Heat	(111)	3	Physics Electricity, Light and Sound	(112)	3
Engineering Drawing Descriptive Geometry	(103)	3	Engineering Drawing Machine Sketching	(104)	3
Ceramic Engineering Ceramic Chemistry	(101)	4	Ceramic Engineering Laboratory	(102)	4
Ceramic Engineering Clays	(141)	3	Ceramic Engineering Clay Wares	(142)	3
Military Drill		1	Military Drill		1

THIRD YEAR

Mechanics Statics and Strength of Materials	(101)	5	Mechanics Strength of Materials	(104)	2
Chemistry Physical Chemistry	(159)	3	Geology	(168)	3
Mine Engineering Mine Surveying	(103)	4	Civil Engineering Trusses	(124)	3
Ceramic Engineering Drying and Burning	(143)	3	Ceramic Engineering Decoration of Clay Wares	(144)	3
Ceramic Engineering Calculations	(105)	2	Ceramic Engineering Physical, Chemical Measurements	(108)	3
Mine Engineering Mine Trip	(109)	1	Mechanical Engineering Mechanism and Design	(110)	3

FOURTH YEAR

FIRST SEMESTER

Ceramic Engineering Laboratory	(111)	5
Ceramic Engineering Drawing	(113)	5
Metallurgy Fuel	(117)	2
Metallurgy Iron and Steel	(119)	2
Metallurgy Pyrometry	(125)	1
Mineralogy Physical Chemical Mineralogy	(105)	2

SECOND SEMESTER

*Ceramic Engineering Laboratory	(112)	5
Ceramic Engineering Drawing	(114)	5
*Ceramic Engineering Cement Lectures	(118)	5
Civil Engineering Cement and Concrete	(118)	3
Ceramic Engineering Thesis	(116)	4

For thesis requirements see page 16.

*Alternative courses. One must be taken.

CHEMICAL ENGINEERING

FOR FIRST YEAR, SEE PAGE 23

SECOND YEAR

Mathematics Calculus	(141)	5
Physics General Physics	(111)	3
Engineering Drawing Descriptive Geometry	(103)	3
Chemistry Quantitative Analysis	(119)	4
Chemistry Advanced General Chemistry	(113)	2
Military Drill		1

Mathematics Calculus	(142)	5
Physics General Physics	(112)	3
Engineering Drawing Machine Sketching	(104)	3
Chemistry Quantitative Analysis	(120)	4
Chemistry Advanced General Chemistry	(114)	2
Chemistry Chemical Problems	(124)	1
Military Drill		1

THIRD YEAR

Mechanics Statics and Strength of Materials	(101)	5
Engineering Drawing Technical Drawing	(121)	2
Metallurgy Fuel	(117)	2
Metallurgy Iron and Steel	(119)	2
Chemistry Organic Chemistry, lectures	(151)	2
Chemistry Organic Chemistry, laboratory	(153)	2
Mechanical Engineering Steam Engineering	(107)	3

Mechanics Kinetics and Hydraulics	(102)	5
Engineering Drawing Technical Drawing	(122)	2
Mineralogy Mineralogy and Crystallography	(102)	3
Chemistry Organic Chemistry, lectures	(152)	2
Elective		5 to 7

Electives in third year, second semester must be chosen from the following courses, subject to approval of the departments concerned: Chemistry (136) 2, Chemical Literature; Chemistry (154) 2 or 3, Advanced Organic Chemistry; Chemistry (168) 3 to 5, Advanced Qualitative Analysis; Chemistry (176) 3, Sanitary Analysis; Chemistry (187) 2 or 3, Inorganic Preparations; Chemistry (192) 2, Rare Elements (given only in odd numbered years); Metallurgy (110) 4, General Metallurgy; Metallurgy (112) 2, Calorimetry and Mine Gas Analysis.

FOURTH YEAR

FIRST SEMESTER			SECOND SEMESTER		
Mechanical Engineering Machine Design	(127)	5	Mechanical Engineering Machine Design	(144)	5
Chemistry Physical Chemistry	(157)	3	Chemistry Physical Chemistry	(158)	3
Chemistry Industrial Chemistry	(177)	2	Chemistry Industrial Chemistry	(178)	1
Chemistry Industrial Chemistry, laboratory	(185)	2	Chemistry Industrial Chemistry, laboratory	(186)	3
Electrical Engineering Elementary Electrical Engineering	(101)	5	Chemistry Thesis	(140)	4
			Chemistry Inspection Trip	(182 or 184)	1
			Elective		2

For thesis requirements see page 16.

CIVIL ENGINEERING

FOR FIRST YEAR, SEE PAGE 23

SECOND YEAR

Mathematics Calculus	(141)	5	Mathematics Calculus	(142)	5
Physics General Physics	(111)	3	Physics General Physics	(125)	5
Engineering Drawing Descriptive Geometry	(105)	3	Engineering Drawing Advanced Descriptive Geometry	(106)	3
Civil Engineering Land Surveying and Field Practice	(101 & 101a)	4 and 1	Civil Engineering R. R. Surveying and Field Practice	(102 & 102a)	4 and 1
Civil Engineering Topographic Drawing	(103)	2	Military Drill		1
Military Drill		1			

SUMMER COURSES—Civil Engineering (104 and 111), each four weeks of six days per week. Four credit hours for each course. Field work in surveying. Required in second and third years respectively.

THIRD YEAR

FIRST SEMESTER

Astronomy Geodesy and Least Squares	(104)	3
Mechanics Statics and Strength of Materials	(101)	5
Civil Engineering Topographic Surveying	(105)	3
Civil Engineering Applied Descriptive Geometry	(107)	2
Civil Engineering Sanitary Engineering	(109)	3
Geology	(168)	3

SECOND SEMESTER

Astronomy Geodesy and Least Squares	(105)	3
*Electrical Engineering	(103)	3
Mechanics Kinetics and Hydraulics	(102)	5
Civil Engineering Timber Construction	(108)	3
Civil Engineering Roads and Pavements	(106)	3
†Civil Engineering Stresses in Structures	(110)	4
‡Civil Engineering Trusses	(124)	3
‡Civil Engineering Engineering Reports	(138)	1

FOURTH YEAR

CIVIL ENGINEERING GROUP

Civil Engineering Bridge Design	(113)	4
Civil Engineering Cement and Concrete	(130)	2
Civil Engineering Masonry Construction	(115)	3
Mechanical Engineering Laboratory	(173)	5
*Civil Engineering R. R. Maintenance	(141)	3
or		
*Civil Engineering Tall Buildings	(125)	3
or		
*Electrical Engineering	(103)	3

*Civil Engineering Railway Location	(112)	4
or		
*Civil Engineering Advanced Bridge Design	(114)	4
Civil Engineering Water Supply	(117)	3
Civil Engineering Masonry Structures and Contracts	(116)	3
Civil Engineering Thesis	(122)	3
Civil Engineering Concrete Design	(129)	3
*Mechanical Engineering Hydraulic Machinery	(142)	2
or		
*Mechanical Engineering Hydraulic Power	(150)	3

For thesis requirements see page 16.

---

*Alternative with Astronomy 105 in Municipal and Sanitary Engineering group.
†Civil Engineering group.
‡Municipal and Sanitary Engineering group.

FOURTH YEAR

MUNICIPAL AND SANITARY ENGINEERING GROUP

FIRST SEMESTER			SECOND SEMESTER		
Civil Engineering Cement and Concrete	(130)	2	Civil Engineering Water Supply	(117)	3
Civil Engineering Masonry Construction	(115)	3	Civil Engineering Masonry Structures and Contracts	(116)	3
Mechanical Engineering Laboratory	(173)	5	Civil Engineering Thesis	(122)	3
Civil Engineering Thesis	(119)	1	Civil Engineering Concrete Design	(129)	3
Civil Engineering Municipal Engineering	(139)	3	Civil Engineering Sanitary and Water Supply Design	(140)	3
*Bacteriology General Bacteriology or	(107)	4	*Bacteriology Water Exam., Sewage Disposal, Water Filtration or	(114)	3
*Chemistry Quantitative Analysis	(119)	3	*Chemistry Sanitary Analysis	(176)	3

For thesis requirements see page 16.
Students will not be permitted to change groups during the senior year.
*Alternative Courses.

ELECTRICAL ENGINEERING

FOR FIRST YEAR, SEE PAGE 23

SECOND YEAR

Mathematics Calculus	(141)	5	Mathematics Calculus	(142)	5
Physics Mechanics and Heat	(113)	5	Physics Electricity, Light and Sound	(114)	4
Engineering Drawing Descriptive Geometry	(103)	3	Physics Laboratory	(134)	4
Physics Laboratory	(133)	2	Engineering Drawing Machine Sketching	(110)	2
Shopwork Machine Work	(119)	3	Shopwork Advanced Machine Work	(121)	3
Military Drill		1	Military Drill		1

THIRD YEAR

Mechanics Statics and Strength of Materials	(101)	5	Mechanics Kinetics and Hydraulics	(102)	5
Physics Laboratory	(135)	5	Electrical Engineering D. C. Machinery	(104)	5
Mechanical Engineering Heat Power Engineering	(105)	3	Mechanical Engineering Heat Power Engineering	(106)	3
Mechanical Engineering Mechanism	(101)	3	Mechanical Engineering Laboratory	(160)	2
Engineering Drawing Technical	(111)	2	Electrical Engineering Applications, A. C. Prin.	(106 & 108)	3
Electrical Engineering Inspection Trip	(131)				

SUMMER COURSE—Electrical Engineering (139), Experience in Practice. Ten weeks during any summer vacation. (To be first required of the class graduating in 1922.)

FOURTH YEAR

FIRST SEMESTER			SECOND SEMESTER		
Mechanical Engineering Laboratory	(175)	3	Electrical Engineering A. C. Laboratory	(112)	3
Electrical Engineering A. C. Laboratory	(111)	3	Electrical Engineering Transmission	(124)	3
Electrical Engineering A. C. Machinery	(109)	3	Industrial Arts Machine Design	(112)	2
Electrical Engineering Elec. Machine Design	(121)	3	Electrical Engineering Thesis	(128)	5
Electrical Engineering	(*)	2	Electrical Engineering Inspection Trip	(130 or 134)	
Electrical Engineering Thesis	(127)	1	Elective		2 to 5
Elective		2 to 4			

For thesis requirements see page 16.

*One of the following: (113) Railways, (115) Telephones, (117) Illumination, (119) Wireless Telegraphy.

GENERAL ENGINEERING

FOR FIRST YEAR, SEE PAGE 23

SECOND YEAR

Mathematics Calculus	(141)	5	Mathematics Calculus	(142)	5
Chemistry Quantitative Analysis	(119)	4	*Chemistry Quantitative Analysis	(120)	4
Physics	(113)	5	Physics	(114)	4
Engineering Drawing	(103)	3	*Physics	(136)	4
Military Drill		1	Engineering Drawing	(104)	3
			Military Drill		1

(1) In addition to the two years outlined above, the student shall obtain credit for 68 semester hours in order to complete the requirements for his degree.

(2) Of these 68 hours, 10 hours must be Mechanics 101 and 102, which shall ordinarily be completed during the third year.

(3) At least 20 hours shall be selected from technical engineering subjects, and 20 hours shall be selected from either technical engineering subjects or from those sciences fundamental to engineering which are included in the Bulletin of the College of Engineering. These subjects must be approved by the engineering department in which the student's principal work is done, and by the Secretary of the College of Engineering.

(4) The production of a thesis shall be optional with the student, subject to the approval of the department concerned.

(5) The remaining 18 hours shall be selected from any work of the University to which the student is eligible, subject to the approval of the Engineering Department having supervision over the last two years of the student's work.

For thesis requirements see page 16.

*Alternative courses. One must be taken.

MECHANICAL ENGINEERING

FOR FIRST YEAR, SEE PAGE 23

SECOND YEAR

FIRST SEMESTER			SECOND SEMESTER		
Mathematics Calculus	(141)	5	Mathematics Calculus	(142)	5
Physics Mechanics and Heat	(113)	5	Physics General Physics	(119)	3
Engineering Drawing Descriptive Geometry	(103)	3	Physics Laboratory	(138)	2
Shopwork Foundry	(105)	2	Engineering Drawing Machine Sketching	(104)	3
Shopwork Chipping and Filing	(107)	2	Shopwork Machine Shop	(119)	3
Shopwork Advanced Pattern Making	(111)	1	Civil Engineering Surveying	(128)	2
Military Drill		1	Military Drill		1

THIRD YEAR

Mechanics Statics and Strength of Materials	(101)	5	Mechanics Kinetics and Hydraulics	(102)	5
Engineering Drawing Technical Drawing	(111)	2	Architecture Photography	(111)	2
Metallurgy Fuel	(117)	2	Civil Engineering Timber and Masonry	(126)	2
Metallurgy Iron and Steel	(119)	2	Mechanical Engineering Mechanism	(114)	3
Mathematics Differential Equations	(151)	1	Mechanical Engineering Mechanism Drawing	(116)	1
Mechanical Engineering Steam Power Plants	(103)	3	Mechanical Engineering Laboratory	(164)	2
Shopwork Advanced Machine Shop	(121)	3	Mechanical Engineering Steam Power Plants	(104)	4

FOURTH YEAR

Civil Engineering Trusses	(124)	3	*Industrial Arts Shop Buildings	(114)	2
Electrical Engineering Elementary Elec. Engineering	(101)	5	*Mechanical Engineering Steam Turbines	(146)	2
Mechanical Engineering Machine Design	(127)	5	*Mechanical Engineering Hydraulic Power	(150)	3
Mechanical Engineering Gas Engines and Producers	(125)	2	Mechanical Engineering Machine Design	(144)	5
Mechanical Engineering Thermodynamics	(129)	2	Mechanical Engineering Hydraulic Machinery	(142)	2
Mechanical Engineering Laboratory	(179)	2	Mechanical Engineering Laboratory	(190)	6
			Mechanical Engineering Thesis	(148)	3
			Mechanical Engineering Inspection Trip	(130 or 134)	

For thesis requirements see page 16.
*Alternative courses. One must be taken.

MINE ENGINEERING

FOR FIRST YEAR, SEE PAGE 23

SECOND YEAR

FIRST SEMESTER			SECOND SEMESTER		
Mathematics Calculus	(141)	5	Mathematics Calculus	(142)	5
Physics General Physics	(111)	3	Physics General Physics	(112)	3
Engineering Drawing Descriptive Geometry	(103)	3	Engineering Drawing Machine Sketching	(104)	3
Chemistry Quantitative Analysis	(119)	3	Metallurgy Laboratory	(106)	4
Mine Engineering Mine Surveying	(103)	4	Mineralogy Mineralogy and Crystallography	(102)	3
Military Drill		1	Mine Engineering Mine Trip	(110)	
			Military Drill		1

THIRD YEAR

Mechanics Statics and Strength of Materials	(101)	5	Mechanics Kinetics and Hydraulics	(102)	5
Metallurgy Fuel	(117)	2	Metallurgy. General Metallurgy	(110)	4
Metallurgy Iron and Steel	(119)	2	Metallurgy Calorimetry, Mine Gas Analysis	(112)	2
Metallurgy Fire Assaying	(105)	2	Mineralogy Determinative Mineralogy	(104)	3
Metallurgy Laboratory	(107)	3	Geology Petrography	(166)	2
Geology General Geology	(165)	3	Civil Engineering Trusses	(124)	3
Mine Engineering Mining Problems	(117)	2			

FOURTH YEAR

Mine Engineering General Mining	(105)	5	Mine Engineering General Mining	(106)	5
Metallurgy Metallurgical Construction	(111)	2	Mine Engineering Plans and Specifications	(104)	4
Metallurgy Ore Dressing	(113)	2	Mechanical Engineering Laboratory	(192)	3
Electrical Engineering	(103)	3	*Mine Engineering Thesis	(116)	3
Geology Economic Geology	(167)	3	*Metallurgy Thesis	(116)	
Architecture Photography	(111)	2	Metallurgy Metallography	(120)	2
			Mine Engineering Ventilation Control	(120)	2
			Metallurgy Pyrometry and Calorimetry	(122)	1

---

*Alternative courses. One must be taken.
For thesis requirements see page 16.

RESERVE OFFICERS TRAINING CORPS

The Faculty of the College of Engineering has passed the following regulations to enable its students to take advantage of the Reserve Officers Training Corps. See page 16.

1. That the first two years of the various engineering curricula remain as they are at present.

2. That those students who have completed two academic years of service in the Senior Division of the Reserve Officers Training Corps, and who have been selected for further military training by the President of the University and the Professor of Military Science and Tactics, and who execute the written agreement or contract to pursue the two years' advanced curriculum, as prescribed in Section 35 of General Orders No. 49, shall receive no academic credit for the prescribed physical work or military drill of said advanced curriculum, but may receive academic credit to the amount of three hours per week during four semesters for the theoretical instruction in military subjects of said curriculum.

3. That a student taking this special military training shall be allowed to substitute, during four semesters, three credit hours of military subjects for which academic credit is given, for the same number of hours of subjects which are now a part of the curriculum leading to the degree sought.

4. That the selection of the subjects in the present curricula for which military credits may be substituted shall be determined by the Executive Committee of the College and the department in which the major work of the student lies.

COMBINATION CURRICULA

Combination curricula leading to two engineering degrees, can be arranged for any two of the foregoing degrees. The amount of additional time will be at least thirty semester hours in excess of that required for one, and may be more. In no case will the student be required to take all of the work not common to the two curricula as published.

For instance a joint curriculum, Mechanical and Electrical Engineering, can be taken in five years. Where the curricula are more diverse, such as Civil Engineering and Mechanical Engineering, six years may be required.

ARTS-ENGINEERING CURRICULA

For the benefit of those who desire to possess the advantage of a wider general culture and a broader foundation than can be given in the limits of a four-year professional curriculum, a combination of three years in the College of Arts, Philosophy and Science and three years in the College of Engineering can be so adjusted as to enable the student to secure the degree of Bachelor of Arts and the appropriate engineering degree.

The College of Engineering desires to establish similar relations with other educational institutions of approved standing in Ohio and elsewhere, by which a student can earn two degrees in five or six years.

GRADUATE WORK

The Graduate School has administrative control of the graduate work in all of the colleges of the University. The conditions under which advanced degrees can be obtained by graduates of the College of Engineering are as follows:

Master's Degree. The degree which will be conferred upon candidates whose major work lies in Engineering, will be that of Master of Science, (M. Sc.). The course of study will consist of one major and either one or two minors, at least one of the minors being in a different department from that in which the major is taken. A residence of one year devoted wholly to graduate work is required, but graduates of this University may complete not more than half of the required work at another institution offering equivalent opportunities for study. Except in certain special cases, a satisfactory thesis is required.

Professional Engineering Degree. Upon nomination by the Faculty of the College of Engineering, the appropriate professional engineering degree of Architect, Architectural Engineer, Ceramic Engineer, Chemical Engineer, Civil Engineer, Electrical Engineer, Engineer of Mines, or Mechanical Engineer may be granted to graduates of this University upon any one of the following plans:

First. Four years of acceptable professional experience and an approved thesis.

Second. A Master of Science degree from this University with a major in engineering, followed by two years of acceptable professional experience and an approved thesis.

Third. One year of acceptable professional experience, followed by one year of approved study at this University, with an appropriate engineering major, and an approved thesis.

DEPARTMENTS OF INSTRUCTION

ARCHITECTURE

Office, 105 Brown Hall

PROFESSORS BRADFORD, CHUBB, AND SMITH,
MR. HASKETT, MR. RONAN

131. Elements of Architecture. Two credit hours. First semester. Architecture, first year; Architectural Engineering, second year. Concurrent with Art 131, Engineering Drawing 101.

132. Elements of Architecture. Two credit hours. Second semester. Architecture, first year; Architectural Engineering, second year. Prerequisite, Architecture 131, and concurrent with Art 132 and Engineering Drawing 102.

133. History of Architecture. Three credit hours. First semester. Architecture and Architectural Engineering, second year. Concurrent, Architecture 131 and Art 131.

134. History of Architecture. Three credit hours. Second semester. Architecture and Architectural Engineering, second year. Prerequisite, Architecture 133.

135. History of Architecture. Two credit hours. First semester. Architecture and Architectural Engineering, third year. Prerequisite, Architecture 134.

History of Renaissance architecture.

136. History of Architecture. Three credit hours. Second semester. Architecture, third year. Prerequisite, Architecture 135.

History of modern architecture.

141. Design. Five credit hours. First semester. Architecture, second year; Architectural Engineering, third year. Prerequisite, Architecture 132.

142. Design. Five credit hours. Second semester. Architecture, second year; Architectural Engineering, third year. Prerequisite, Architecture 141.

150. Wood Construction. Five credit hours. Second semester. Architecture and Architectural Engineering, third year. Prerequisite, Architecture 141 and Mechanics 103.

143. Design. Five credit hours. First semester. Architecture, third year; Architectural Engineering, fourth year. Prerequisite, Architecture 142.

144. Design. Five credit hours. Second semester. Architecture, third year. Prerequisite, Architecture 143.

145. Design. Five credit hours. First semester. Architecture, fourth year. Prerequisite, Architecture 144.

146. Design. Five credit hours. Second semester. Architecture, fourth year. Prerequisite, Architecture 145.

123. Fire Protection. Two credit hours. Second semester. Architectural Engineering, fourth year. Concurrent, Civil Engineering 125.

151. Masonry. Three credit hours. First semester. Architecture and Architectural Engineering, fourth year. Prerequisite, Architecture 150.

147. Ornament. Four credit hours. First semester. Architecture, fourth year. Prerequisite, Architecture 144 and 113.

153. Plumbing. Two credit hours. First semester. Architectural Engineering, fourth year.

111. Photography. Two credit hours. Either semester. Architecture, Architectural Engineering, Mechanical Engineering, and Civil Engineering, third year; Mine Engineering, fourth year. Prerequisite, Chemistry 105-106, or 109-110. Mr. Haskett.

113. Principles of Architectural Composition. Two credit hours. First semester. Architecture, third year. Prerequisite, Architecture 134. Mr. Chubb.

116. Professional Practice. Four credit hours. Second semester. Architecture, fourth year. Prerequisite, Architecture 151. Mr. Bradford.

117. Sanitary Plumbing. One credit hour. First semester. Architecture, fourth year. Mr. Bradford.

118. Thesis. Five credit hours. Second semester. Architecture, fourth year. Mr. Bradford, Mr. Chubb, Mr. Ronan.

120. Summer Work. Four credit hours. The equivalent of four weeks of work in an architect's office, or a problem in design assigned by the department. Between the second and third years.

121. Summer Work. Four credit hours. The equivalent of four weeks of work in an architect's office, or a problem in design assigned by the department. Between the third and fourth years.

122. Photography. Two credit hours. Second semester. Prerequisite, Architecture 111. Mr. Haskett.

124. Shades, Shadows, and Perspective. Three credit hours. Second semester. Architecture, second year. Prerequisite, Engineering Drawing 107. Mr. Ronan.

FOR GRADUATES

201-202. Architecture.

203-204. Architecture. Research Work.

For description of graduate courses in this department see the Bulletin of the Graduate School.

ART

Office, 203 Hayes Hall

PROFESSOR KELLEY, MR. NORRIS

131-132. Elementary Drawing. Two credit hours. The year. Four laboratory hours each week. Architecture, second year.

This course is designed to develop a thorough knowledge of form and values in black and white, also the use of freehand perspective.

Art 131 is given also during the second semester.

133. Advanced Drawing. Two credit hours. Either semester. Four laboratory hours each week. Architecture, third year. Prerequisite, Art 131-132.

This course is designed to give the student some freedom in the use of drawing as a medium of expression. Drawing from the antique and the costume model.

141. Elementary Design. Two credit hours. Either semester. Prerequisite, Art 131.

The principles of the theory and practice of design.

136. Water Color. Two credit hours. First semester. Architecture, third year. Prerequisite, Art 133 and 141.

162. Water Color. Two credit hours. Second semester. Architecture, third year. Prerequisite, Art 136.

163-164. Drawing from Life. Two credit hours. The year. Architecture, fourth year.

ASTRONOMY

Office, Emerson McMillin Observatory

PROFESSOR LORD, ASSOCIATE PROFESSOR MANSON

104-105. Astronomy, Geodesy, and Least Squares. Three credit hours. The year. Civil Engineering, third year. Prerequisite, the calculus. Mr. Lord, Mr. Manson.

107-108. Advanced Astronomy.

109-110. The Theory of Lenses.

111-112. Introduction to Celestial Mechanics.

For description of graduate courses in this department see the Bulletin of the Graduate School.

CERAMIC ENGINEERING

Office, 26 Lord Hall

PROFESSOR WATTS, RESEARCH PROFESSOR ORTON, ASSISTANT PROFESSORS HARROP AND WILSON, MR. LYSATT

101. Ceramic Chemistry. Four credit hours. First semester. Ceramic Engineering, second year. Prerequisite, Chemistry 106 or 110.

Quantitative analysis of limestone and simple minerals.

102. Ceramic Chemistry. Four credit hours. Second semester. Ceramic Engineering, second year. Prerequisite, Ceramic Engineering 101.

Quantitative analysis of clays, fire-gases, etc.

105. Ceramic Calculations. Two credit hours. First semester. Ceramic Engineering, third year. Prerequisite, Ceramics 101. Mr. Wilson.

Calculations involved in blending of ingredients used in ceramic mixtures; determinations of limits of variation in given series; limits of errors; volume calculations; problems in heat.

108. Physical and Chemical Measurements of Clays. Three credit hours. Second semester. Ceramic Engineering, third year. Mr. Watts, Mr. Wilson.

Application of physical chemical laws to ceramic materials. Determination of the vital physical properties of ceramic materials, mixtures and compounds in plastic, dry, vitrified and fused state.

111-112. Laboratory Work in Ceramics. Five credit hours. The year. Ceramic Engineering, fourth year. Prerequisite, Ceramics 108 and 144. Mr. Watts, Mr. Wilson.

Practice in clay testing. The production of bodies made from single clays and of clays with minerals. In each case the bodies are burned and tested. The production of slips, engobes and glazes, and the study of the methods of coloring.

113-114. Ceramic Designing. Five credit hours. The year. Ceramic Engineering, fourth year. Prerequisite, Ceramics 144. Mr. Harrop.

Designing, estimating cost of, and writing specifications for factory structures, machinery equipment, kilns, driers, power plants, chimneys, etc.

116. Thesis. Four credit hours. Second semester. Ceramic Engineering, fourth year.

118. Cement Manufacture. Five credit hours. Second semester. Alternative with Ceramics 112, Ceramic Engineering, fourth year. Prerequisite, Ceramics 102 and 144. Mr. Harrop.

The theory of hydraulicity, the compounding, manufacture, and testing of natural and Portland cements, and other hydraulic bodies.

141-142. Ceramic Lectures. Three credit hours. The year. Ceramic Engineering, second year. Mr. Watts, Mr. Harrop.

Origin of clays, constitution, properties, and winning of ceramic materials. General principles of the preparation and forming of clay wares.

143-144. Ceramic Manufacture. Three credit hours. The year. Ceramic Engineering, third year. Mr. Watts, Mr. Harrop.

The drying and burning of clay wares. Glazing and decoration of clay wares.

FOR GRADUATES

201-202. Research Work.

203-204. Testing of Clays with Reference to their Industrial Adaptability.

205-206. Porcelain for Electrical and Other Special Purposes.

208. Advanced Experimental Work.

For description of graduate courses in this department see the Bulletin of the Graduate School.

CHEMISTRY

Office, 100 Chemistry Hall

PROFESSORS McPHERSON, HENDERSON, FOULK, W. L. EVANS,
AND WITHROW, ASSISTANT PROFESSORS BOORD AND
DAY, MR. ADKINS, MR. VILBRANDT, MR. HOLLINGSWORTH, MR. MELLON, MR. HOOVER,
MR. STARR, MR. MARLING, MR. LOOKER,
AND DEPARTMENT ASSISTANTS

105. Elementary Chemistry. Four credit hours. Either semester. One lecture, one quiz, and six laboratory hours each week. Required of first-year students in all four-year courses who have not presented chemistry as an entrance credit. Mr. Evans, Mr. Day, and department assistants.

A general course on the chemistry of the non-metals.

106. Elementary Chemistry and Qualitative Analysis. Four credit hours. Either semester. A continuation of Chemistry 105. Mr. Evans, Mr. Day, and department assistants.

A general course in the chemistry of the metals. The laboratory work accompanying is a general introductory course in qualitative analysis.

109. General Chemistry. Four credit hours. Either semester. One lecture, one quiz, and six laboratory hours each week. Taken by first-year students in all four-year courses who have presented chemistry as an entrance credit. Mr. Evans, Mr. Day, and department assistants.

A general course on the chemistry of non-metals.

110. General Chemistry and Qualitative Analysis. Four credit hours. Either semester. A continuation of Chemistry 109. Mr. Evans, Mr. Day, and department assistants.

A general course in the chemistry of the metals. It is more advanced than Chemistry 106. The laboratory work is a general course in qualitative analysis.

113-114. Advanced General Chemistry. Two credit hours. The year. Two lectures each week. Chemical Engineering, second year. Prerequisite, Chemistry 106 or 110. Mr. Henderson, Mr. Mellon.

A course on the fundamental topics of general chemistry designed as a thorough review and extension of the first-year courses.

117. Qualitative Analysis. Three credit hours. First semester. One lecture and six laboratory hours each week. Prerequisite, an acceptable course in general chemistry. Mr. Hollingsworth.

119. Quantitative Analysis. (a) Three credit hours. First semester. One lecture and six laboratory hours each week. Mine Engineering, second year. (b) Four credit hours. First semester. One lecture and nine laboratory hours each week. Chemical Engineering, second year. Prerequisite, Chemistry 106 or 110. It is desirable that this course be accompanied by Chemistry 113. Mr. Foulk, Mr. Hollingsworth, Mr. Ort.

The elementary principles of gravimetric and volumetric analysis.

120. Quantitative Analysis. Four credit hours. Second semester. One lecture and nine laboratory hours each week. Chemical Engineering, second year. Prerequisite, Chemistry 119. Mr. Foulk, Mr. Hollingsworth, Mr. Ort.

A continuation of Chemistry 119 with typical analytical methods in gravimetric and volumetric analysis. This course should be accompanied by Chemistry 124. It is desirable that it be accompanied by Chemistry 114.

124. Chemical Problems. One credit hour. Second semester. Chemical Engineering, second year. Mr. Foulk, Mr. Hollingsworth.

Extended practice in the solution of problems pertaining to gravimetric and volumetric analysis. This course is arranged to accompany Chemistry 120.

136. The Reading of Chemical Literature. Two credit hours. Second semester. Chemical Engineering, elective, third year. Prerequisite, one year of German. Mr. Foulk.

The object of this course is to afford practice in the rapid reading of German chemical literature, the selections being made with special reference to the technical terms of the science.

140. Thesis. Four credit hours. Second semester. Chemical Engineering, fourth year. Mr. McPherson, Mr. Henderson, Mr. Foulk, Mr. Evans, Mr. Withrow.

151-152. Organic Chemistry. Two credit hours. The year. Two lectures each week. Chemical Engineering, third year. Prerequisite, Chemistry 114 and 120. Mr. McPherson.

General course in organic chemistry.

153-154. Organic Chemistry. Two or three credit hours. The year. Six or nine laboratory hours each week. Chemical Engineering, third year. Must be accompanied or preceded by Chemistry 151 and 152. Mr. McPherson, Mr. Boord, Mr. Adkins.

A general course in the preparation of typical organic compounds.

155. Quantitative Organic Analysis. Two credit hours. First semester. Six hours conference and laboratory work each week. Elective. Prerequisite, Chemistry 153-154. Mr. Boord.

The ultimate analysis of organic compounds and the determination of radicals.

156. Qualitative Organic Analysis. Two credit hours. Second semester. Six hours conference and laboratory work each week. Elective. Prerequisite, Chemistry 153-154. Mr. Boord.

A study of the systematic classification of organic compounds for analysis. Separation, purification and identification of organic compounds.

157-158. Physical Chemistry. Three credit hours. The year. Three lectures each week. Chemical Engineering, fourth year; Ceramic Engineering, third year. Prerequisite, Chemistry 114, 120, and 152. Mr. Henderson.

This is a general course in physical chemistry.

159. Physical Chemistry. Three credit hours. First semester. Three recitations each week. Ceramic Engineering, third year. Prerequisites, Ceramics 102 or Chemistry 120. Mr. Henderson.

A course in the practical application of physical chemistry, with emphasis upon the phase rule, the properties of solutions and colloids.

For advanced undergraduates and graduates.

161. Physical Chemistry. Two or three credit hours. Either semester. Six or nine laboratory hours each week. Elective. Prerequisite or concurrent, Chemistry 157. Mr. Henderson, Mr. Mellon.

A laboratory course designed to illustrate the general lecture course 157-158.

165. Quantitative Analysis. Two credit hours. First semester. Two recitations each week. Prerequisite, Chemistry 119-120, or equivalent. Mr. Foulk.

Advanced course. A general survey of the methods of quantitative analysis.

167. Special Methods of Analysis. Three to five credit hours. First semester. One lecture and six to twelve laboratory hours each week. Chemical Engineering, elective, third year. Prerequisite, Chemistry 119-120. Mr. Hollingsworth.

Selections may be made from gas analysis, micro-chemical analysis and spectrum analysis. Time to be arranged.

168. Qualitative Analysis. Three to five credit hours. Second semester. One lecture, six to twelve laboratory hours each week. Chemical Engineering, elective, third year. Prerequisite, Chemistry 120, or equivalent. Mr. Hollingsworth.

Advanced course. Extended work in general qualitative analysis including the more important of the rare elements.

169. Quantitative Analysis. Three to five credit hours. First semester. One conference and six to twelve laboratory hours each week. Prerequisite, Chemistry 119-120, or equivalent. Mr. Foulk.

Advanced course. A laboratory course in advanced quantitative analysis.

176. Water Analysis. Three credit hours. Second semester. Two lectures and three laboratory hours each week. Chemical Engineering, elective, third year. Prerequisite, Chemistry 120, or equivalent. Mr. Foulk.

The methods of sanitary and industrial water analysis and interpretation of results.

177. Industrial Chemistry. Two credit hours. First semester. Two lectures each week. Prerequisite, Chemistry 113-114 and 153. Mr. Withrow.

The principles underlying the application of chemistry to the problems of the industries.

178. Industrial Chemistry. One credit hour. Second semester. One lecture each week. Prerequisite, Chemistry 177. Mr. Withrow.

182. Industrial Inspection Trip. A six-day excursion at a suitable time in connection with Chemistry 177-178 for the inspection of industrial chemical processes in actual operation. The entire expense is about $45. A satisfactory report on the work inspected is required. Mr. Withrow, Mr. Vilbrandt.

184. Written Reports. A course of assigned reading upon some industrial chemical process and a written report of the same. This is a substitute for Chemistry 182, but the substitution is only allowed upon presentation of reasons satisfactory to the instructor in charge. Mr. Withrow.

185. Industrial Chemistry. Two credit hours. First semester. One conference, five laboratory hours each week. Prerequisite, Chemistry 119-120. Prerequisite or concurrent, Chemistry 177. Mr. Withrow, Mr. Vilbrandt.

Industrial chemical research.

186. Industrial Chemistry. Three credit hours. Second semester. One conference, and eight laboratory hours each week. Prerequisite, Chemistry 119-120. Prerequisite or concurrent, Chemistry 177-178. Mr. Withrow, Mr. Vilbrandt.

Industrial chemical research and technical analysis.

187. Inorganic Preparations. Three credit hours. Either semester. One recitation and six laboratory hours each week. (Laboratory open afternoons.) Chemical Engineering, elective, third year. Prerequisites, Chemistry 114 and 120. Mr. Henderson, Mr. Mellon.

The preparation of a limited number of compounds chosen so as to give practice in the preparation of inorganic compounds.

***192. Rare Elements.** Two credit hours. Second semester. Two lectures each week. Elective. Prerequisite, Chemistry 114 and 120. Mr. Henderson.

The chemistry of the rare elements, including a discussion of their increasing economic importance.

194. Applied Electro-Chemistry. Two credit hours. Second semester. Two lectures each week. Elective. Prerequisite or concurrent, Chemistry 158, except by the special permission of the instructor. Mr. Withrow.

The application of the electric current in chemical industries.

---

*Not given in 1919-1920.

FOR GRADUATES

201-202. Physical Chemistry.

205-206. Organic Chemistry.

209-210. Inorganic Preparations.

***213. Historical Chemistry.**

215. Seminary in Organic Chemistry.

***216. Seminary in Organic Chemistry.**

***217. Seminary in Organic Chemistry.**

218. Seminary in Organic Chemistry.

221. Seminary in Inorganic Chemistry.

***224. Seminary in Physical Chemistry.**

225. Seminary in Advanced Industrial Chemistry.

226. Seminary in Advanced Industrial Chemistry.

***227. Scientific Foundations of Analytical Chemistry.**

235-236. Research Work.

239. Seminary in Analytical Chemistry.

For description of graduate courses in this department see the Bulletin of the Graduate School.

CIVIL ENGINEERING

Office, 108 Brown Hall

PROFESSORS SHERMAN, ENO, AND MORRIS, ASSISTANT PROFESSORS SLOANE AND SHANK, MR. NEILSON, MR. WEBER

101. Land Surveying. Four credit hours. First semester. Four recitations each week. Civil Engineering, second year. Prerequisite, Mathematics 132, Engineering Drawing 102. Mr. Sherman, Mr. Eno, Mr. Sloane.

Care and use of instruments. Farm, city and hydrographic surveying.

101a. Field Practice. One credit hour. First semester. Three hours each week in field. Civil Engineering, second year.

---

*Not given in 1919-1920.

Prerequisite or concurrent, Civil Engineering 101. Mr. Hindman, and department instructors.

Field exercises in use of instruments and surveying.

102. Railroad Surveying. Four credit hours. Second semester. Four recitations each week. Civil Engineering, second year. Prerequisite, Civil Engineering 101 and 101a. Mr. Sherman, Mr. Sloane.

Simple, compound and transition curves, frogs, switches and earthwork.

102a. Field Practice. One credit hour. Second semester. Three hours each week in field. Civil Engineering, second year. Prerequisite or concurrent, Civil Engineering 102. Mr. Sloane, and department instructors.

Field practice in laying out curves, frogs, switches and earthwork.

103. Topographic Drawing. Two credit hours. First semester. Six hours each week in drafting room. Civil Engineering, second year. Prerequisite, Engineering Drawing 102. Mr. Sherman, Mr. Eno.

Exercises in black ink and color topographic drawing.

104. Summer Surveying Camp. Four credit hours. Civil Engineering, at close of second year. Prerequisite, Civil Engineering 101a and 102a.

Four weeks of six days each of ten hours a day, from the middle of June to the middle of July.

105. Topographic Surveying. Three credit hours. First semester. Nine hours each week in field or drawing room. Civil Engineering, third year. Prerequisite, Civil Engineering 101, 102, and 104. Mr. Sloane.

Field and office work in four or five kinds of topographic surveying.

106. Roads and Pavements. Three credit hours. Second semester. Three recitations each week. Civil Engineering, third year. Prerequisite, Civil Engineering 102 and 104. Mr. Eno.

A study of materials and the principles of construction for rural highways and city pavements.

107. Applied Descriptive Geometry. Two credit hours. First semester. One recitation and one drawing period each week. Civil Engineering, third year. Prerequisite, Engineering Drawing 106. Mr. Sloane.

Descriptive geometry and projections applied to engineering structures in timber, steel, and masonry.

108. Timber Construction. Three credit hours. Second semester. Recitations and drawing. Civil Engineering, third year. Prerequisite, Engineering Drawing 105; concurrent, Mechanics 102. Mr. Sloane.

Design of timber structures, identification and properties of various trees and timbers.

109. Sanitary Engineering. Three credit hours. First semester. Three recitations each week. Civil Engineering, third year. Prerequisite, Civil Engineering 102 and 104. Mr. Eno.

A study of the principles of sewerage collection systems as applied to the design of separate and combined sewers and storm drains and the study of sewage disposal.

110. Stresses in Structures. Four credit hours. Second semester. Four recitations each week. Civil Engineering group, third year. Prerequisite or concurrent, Mechanics 102. Mr. Morris.

A course in the theory of stresses in roofs and bridges.

111. Summer Surveying Camp. Four credit hours. Civil Engineering at close of third year. Prerequisite, Civil Engineering 104 and 105.

Four weeks of six days each of ten hours a day, from the middle of June to the middle of July.

112. Railway Location. Four credit hours. Second semester. Four recitations each week. Optional with Civil Engineering 114. Civil Engineering, fourth year. Prerequisite, Civil Engineering 102 and 111 and Mechanics 102. Mr. Sherman.

A railway project used to illustrate engineering economics in construction, operation, and finance.

113. Bridge Design. Four credit hours. First semester. Four recitations each week. Civil Engineering group, fourth year. Prerequisite, Civil Engineering 110. Mr. Morris.

A course in designing and detailing roofs and bridges.

114. Advanced Bridge Design. Four credit hours. Second semester. Four recitations each week. Optional with Civil Engineering 112. Civil Engineering group, fourth year. Prerequisite, Civil Engineering 113. Mr. Morris.

The theory of stresses in and design of cantilever, swing and arch bridges.

115. Masonry Construction. Three credit hours. First semester. Three recitations each week. Civil Engineering, fourth year. Prerequisite, Civil Engineering 111, Mechanics 102. Mr. Sherman.

Review of the materials of masonry construction, and of the general subject of foundations.

116. Masonry Structures and Contracts. Three credit hours. Second semester. Three recitations, lecture, or drawing periods each week. Civil Engineering, fourth year. Prerequisite, Civil Engineering 115. Mr. Sherman.

Dams, retaining walls, piers, abutments, culverts, first two-thirds of term. Contracts and specifications, last third.

117. Water Supply. Three credit hours. Second semester. Three recitations each week. Civil Engineering, fourth year. Prerequisite, Civil Engineering 111, Mechanics 102. Mr. Eno.

A study of hydrology, sources and character of water supply, water borne diseases, construction details of water works, the purification, distribution and operation of public water supplies.

118. Cement and Concrete. Three credit hours. Second semester. Two three-hour laboratory periods each week. Ceramic Engineering, fourth year. Prerequisite, Mechanics 102 or 103.

Recitations and laboratory work in concrete materials including the testing and mixing of them and the theory of stresses in reinforced concrete.

119. Thesis. One credit hour. First semester. Civil Engineering, fourth year. Prerequisite, Civil Engineering 110 and 111.

122. Thesis. Three credit hours. Second semester. Civil Engineering, fourth year. Prerequisite, Civil Engineering 119.

124. Trusses. Three credit hours. Either semester. Three recitations each week first three-fourths of semester, drawing room work last one-fourth of semester. Mechanical Engineering, fourth year; Architecture, Ceramic Engineering, Civil Engineering (Municipal and Sanitary Engineering group), Mine Engineering, third year. Prerequisite or concurrent, Mechanics 102 and 104.

Stresses in and design of steel-framed buildings.

125. Tall Buildings. Three credit hours. First semester. Three lectures or recitations each week. Architectural Engineering, fourth year. Optional in Civil Engineering group, fourth year. Prerequisite, Civil Engineering 124 or concurrent. Civil Engineering 113. Mr. Morris.

Stresses in and design of steel-framed office buildings.

126. Timber and Masonry. Two credit hours. Second semester. Two lectures or recitations each week. Mechanical Engineering, third year. Prerequisite, Mechanics 101.

128. Plane Surveying. Two credit hours. Second semester. One lecture and one field exercise of three hours each week. Architecture, fourth year. Mechanical Engineering, second year. Prerequisite, Engineering Drawing 102, Mathematics 132. Mr. Neilson.

129. Concrete Design. Three credit hours. Second semester. Three recitations each week. Architectural and Civil Engineering, fourth year. Prerequisite, Civil Engineering 113 or 124, Mechanical Engineering 123 or 173, and prerequisite or concurrent, Civil Engineering 118 or 130. Mr. Morris.

Design of reinforced concrete structures.

130. Cement and Concrete. Two credit hours. Either semester. Two three-hour laboratory periods each week. Architecture, Architectural and Civil Engineering, fourth year. Prerequisite, Mechanics 102 or 103.

Recitations and laboratory work in concrete materials, including the testing and mixing of them.

138. Engineering Reports. One credit hour. Second semester. One recitation or report period each week. Civil Engineering (Municipal and Sanitary Engineering group), third year. Prerequisite, Civil Engineering 109. Mr. Eno.

Discussions and written reports upon various municipal and engineering activities and structures.

139. Municipal Engineering. Three credit hours. First semester. Three recitations each week. Civil Engineering (Municipal and Sanitary Engineering group), fourth year. Prerequisite, Civil Engineering 106. Mr. Eno.

A course covering city planning, street cleaning and maintenance, garbage and wastes disposal, and kindred subjects.

140. Sanitary and Water Supply Design. Three credit hours. Second semester. One recitation and two drawing periods each week. Civil Engineering (Municipal and Sanitary Engineering group), fourth year. Prerequisite, Civil Engineering 109 and concurrent, Civil Engineering 117. Mr. Eno.

The working of sanitary and water supply problems, assigned readings, the design of sewage collection and water distribution systems, and the design of sewage disposal and water purification plants and appurtenances.

141. Railway Maintenance. Three credit hours. First semester. Three recitations each week. Optional with Civil Engineering 125, Civil Engineering, fourth year. Prerequisite, Civil Engineering 102 and 111.

Railway maintenance problems. Design of tracks and structures. Visits of inspection.

FOR GRADUATES

201-202. Investigation and Design.

203. Railway Maintenance of Way.

204. Railway Yards and Terminals.

205. Rail and Water Transportation.

206. River Regulation and Improvement.

207. Design Work in Sewage Disposal Plants.

208. Design Work in Municipal Water Supplies.

209. Advanced Bridge Design.

210. Concrete Structural Design.

For description of graduate courses in this department see the Bulletin of the Graduate School.

ELECTRICAL ENGINEERING

Office, 171 Robinson Laboratory

PROFESSORS CALDWELL, FLOWERS, AND WRIGHT, MR. SHEPARDSON,
MR. BROWN, MR. PUCHSTEIN

101. Electrical Engineering. Five credit hours. First semester. Three lectures and four laboratory hours each week. Chemical Engineering and Mechanical Engineering, fourth year. Prerequisite, Physics 112 or Physics 114. Mr. Shepardson.

Lectures and laboratory work on direct and alternating current circuits, dynamo machinery, transformers, accumulators, and their applications.

103. Electrical Engineering. Three credit hours. Either semester. Two lectures and three laboratory hours each week. Mine Engineering, fourth year. Civil Engineering (Civil Engineering group), fourth year, alternate with Civil Engineering 125 and Civil Engineering 141; Civil Engineering (Municipal and Sanitary Engineering group), third year, alternate with Astronomy 105. Prerequisite, Physics 112 or 114. Mr. Wright.

Lectures and laboratory work on direct current machinery, circuits and transmission.

104. Direct Current Machinery. Five credit hours. Second semester. Three lectures and four laboratory hours each week. Electrical Engineering, third year. Prerequisite, Physics 135, Mathematics 142, and Mechanics 101. Mr. Flowers, Mr Shepardson.

Generators and motors, a study of their theory, construction and operation. Lectures, recitations, problems and laboratory.

106. Applications of Electricity. One and one-half credit hours. Second semester. Three lectures each week for one-half semester. Electrical Engineering, third year. Prerequisite, Physics 135 and Mathematics 142. Mr. Caldwell and others.

A brief treatment of the use of electricity, in illumination, railways, telephones, radio, mining, etc.

108. Alternating Current Circuits and Machinery. One and one-half credit hours. Three lectures each week for first half of second semester. Electrical Engineering, third year. Prerequisite, Mathematics 142, Physics 135, Mechanics 101; concurrent, Electrical Engineering 104. Mr. Caldwell.

Elementary treatment of circuits and equipment.

109. Alternating Current Machinery. Three credit hours. First semester. A continuation of Electrical Engineering 108. Three lectures each week. Electrical Engineering, fourth year. Prerequisite, Electrical Engineering 108; concurrent, Electrical Engineering 111. Mr. Caldwell.

Advanced treatment of transformers, synchronous motors, induction motors, etc.

111-112. Alternating Current Laboratory. Three credit hours. The year. Electrical Engineering, fourth year. Prerequisite, Electrical Engineering 108; concurrent, Electrical Engineering 109. Mr. Brown.

Alternating current apparatus and accumulators.

113. Electric Railways. Two credit hours. First semester. Electrical Engineering, fourth year. Alternative with Electrical Engineering 115, 117, and 119. Prerequisite, Electrical Engineering 104; concurrent, Electrical Engineering 109. Mr. Shepardson.

Systems, apparatus, and railway operation.

115. Telephony. Two credit hours. First semester. Electrical Engineering, fourth year. Alternative with Electrical Engineering 113, 117, and 119. Prerequisite, Electrical Engineering 104 and 108. Mr. Wright.

Methods of telephone operation, simple circuits, apparatus and elements of transmission theory.

117. Electric Illumination. Two credit hours. First semester. Electrical Engineering, fourth year. Alternative with Electrical Engineering 113, 115, and 119. Architectural Engineering, third year. Prerequisite, Physics 112. Mr. Caldwell.

Principles of illumination, electric lamps, etc.

119. Wireless Telegraphy. Two credit hours. First semester. Electrical Engineering, fourth year. Alternative with Electrical Engineering 113, 115, and 117. Prerequisites, Electrical Engineering 104 and 108. Mr. Brown.

Elementary theory, production, transmission, and detection of damped and undamped oscillations.

121. Electrical Design. Three credit hours. First semester. Two three-hour drawing periods each week. Electrical Engineering, fourth year. Prerequisite, Electrical Engineering 104. Mr. Flowers, Mr. Puchstein.

Design of direct current dynamos, transformers, etc.

122. Electrical Design. Two credit hours. Second semester. A continuation of Electrical Engineering 121. One four-hour drawing period each week. Electrical Engineering, fourth year. Elective. Mr. Flowers.

Alternating current apparatus.

124. Electrical Transmission and Distribution. Three credit hours. Second semester. Three lectures each week. Electrical Engineering, fourth year. Prerequisites, Electrical Engineering 109. Mr. Caldwell.

Transmission and distribution systems, apparatus, organization, and operation.

125-126. Special Reading and Laboratory. Credit hours to be arranged. The year. Elective for fourth year electrical engineering and graduate students with the consent of the instructor in charge. Prerequisites, Electrical Engineering 104 and 108. Mr. Caldwell, Mr. Flowers, Mr. Wright.

127. Thesis. One credit hour. First semester. Electrical Engineering, fourth year. Prerequisites, Electrical Engineering 104 and 108.

128. Thesis. Five credit hours. Second semester. Electrical Engineering, fourth year.

130. Inspection Trip. Electrical Engineering, fourth year. Prerequisite, Mechanics 102.

Includes Pittsburgh, Buffalo, Niagara, and Cleveland. The entire expense need not exceed $45. A satisfactory written report on the work of the trip and an examination are required.

134. Reading Course. Electrical Engineering, fourth year. This may be taken as a substitute for Electrical Engineering 130 on presentation of reasons satisfactory to the head of the department.

Assigned reading on processes of manufacture and power plants.

131. Inspection Trip. First semester. Electrical Engineering, third year. Visits to works of electrical and industrial interest at Columbus, Dayton, and other nearby points. A written report and examination are required.

138. Advanced Laboratory. Two credit hours. Second semester. One four-hour laboratory period. Electrical Engineering, fourth year. Elective. Mr. Caldwell.

Selected tests on alternating current, apparatus, illumination, railways, etc.

139. Experience in Practice. Ten weeks during any summer vacation. Electrical Engineering.

The student shall present a satisfactory report upon the work done. This report shall include a discussion of the student's observations upon the human aspects of the work with which he was connected. The occupation, the work done, and the report shall be subject to approval by the department of Electrical Engineering. If a student has had not less than twelve months of satisfactory practical experience, he may be permitted to substitute a satisfactory report upon such practical work for the above requirement.

In case any student is unable to obtain an opportunity for such practical experience as will fulfill the above requirement, he may be permitted by the department to substitute eight credit hours of approved academic courses for the same. This requirement shall first go into effect with the class graduating in 1922.

FOR GRADUATES

201-202. Advanced Alternating Current Machinery.

203-204. Transient Electrical Phenomena.

205-206. Advanced Alternating Current Dynamo Laboratory.

207-208. Research Work.

For description of graduate courses in this department see the Bulletin of the Graduate School.

ENGINEERING DRAWING

Office, 204 Brown Hall

PROFESSOR FRENCH, ASSISTANT PROFESSORS MEIKLEJOHN,
WILLIAMS, TURNBULL, AND SVENSEN, MR. FIELD,
AND DEPARTMENT ASSISTANTS

101. Elementary Mechanical Drawing. Two credit hours. Either semester. All four-year courses, first year. Mr. French and department instructors.

Practice in the use of drawing instruments, elementary projections.

102. Mechanical Drawing. Three credit hours. Either semester. All four-year courses, first year. Prerequisite, Engineering Drawing 101. Lettering, orthographic, isometric, and oblique projections. Mr. French and department instructors.

103. Descriptive Geometry. Three credit hours. First semester. Two recitations, one drawing period each week. Ceramic, Chemical, Electrical, Mechanical, and Mining Engineering, second year. Prerequisite, Engineering Drawing 102 or 114. Mr. French and department instructors.

104. Machine Drawing. Three credit hours. Second semester. One lecture, two drawing periods each week. Ceramic, Chemical, Mechanical and Mine Engineering, second year. Prerequisite, Engineering Drawing 103. Mr. Williams, Mr. Svensen.

105. Descriptive Geometry. Three credit hours. First semester. Two lectures, one drawing period each week. Civil

Engineering, second year. Prerequisite, Engineering Drawing 102. Mr. Turnbull.

106. Advanced Descriptive Geometry. Three credit hours. Second semester. Two lectures, one drawing period each week. Civil Engineering, second year. Prerequisite, Engineering Drawing 105. Mr. Turnbull.

107. Descriptive Geometry. Three credit hours. First semester. Two recitations, one drawing period each week. Architecture, second year. Prerequisite, Engineering Drawing 102. Mr. Meiklejohn.

110. Technical Drawing. Two credit hours. Second semester. Electrical Engineering, second year. Prerequisite, Engineering Drawing 103. Mr. Williams.

111. Technical Drawing. Two credit hours. First semester. Mechanical and Electrical Engineering, third year. Prerequisite, Engineering Drawing 104 or 110. Mr. Williams, Mr. Svensen.

121-122. Technical Drawing. Two credit hours. The year. Chemical Engineering, third year. Prerequisite, Engineering Drawing 104. Mr. J. R. Withrow, Mr. Svensen.

Designing of chemical plants and machinery.

ENGLISH

Office, 103 Physics Building

PROFESSOR DENNEY, ASSISTANT PROFESSORS BECK, ANDREWS, AND PERCIVAL, MR. CRAIG, MR. DISHONG, MR. WILEY, MISS ROBINSON, MR. FOLEY, MISS DOLLINGER, MR. GYSAN, AND DEPARTMENT ASSISTANTS

101. Paragraph Writing: Description and Narration. Two credit hours. Either semester. All instructors.

English 101 is given also in the Summer Session.

104. Paragraph Writing: Exposition and Argumentation. Two credit hours. Either semester. Prerequisite, English 101. All instructors.

English 104 is given also in the Summer Session.

GEOLOGY

Office, 104 Orton Hall

PROFESSORS BOWNOCKER AND CARMAN, ASSISTANT PROFESSORS HILLS AND TUCKER, MR. BEVAN, MISS MORNINGSTAR

165. Geology. Three credit hours. First semester. Two recitations and two laboratory hours each week. Mine Engineering, third year. Mr. Carman, Mr. Bevan.

During part of the semester, field trips on Saturday morning will take the place of the laboratory work.

The application of the principles of geology to mine engineering. Structural geology, dynamic geology and a briefer consideration of physiographic and historical geology.

166. Petrography. Two credit hours. Second semester. Mine Engineering, third year. Mr. Bownocker.

A study of hand specimens of igneous, metamorphic, and sedimentary rocks. Lectures and laboratory work.

167. Economic Geology. Three credit hours. First semester. Three recitations each week. Mine Engineering, fourth year. Prerequisite, Geology 165 and 166. Mr. Bownocker.

A study is made of the nature of ores, their classification and origin; the metallic ores in the United States, their distribution, abundance, modes of occurrence and origin. The coals of the Appalachian field.

168. Geology. Three credit hours. Either semester. Two recitations and two laboratory hours each week. Ceramic and Civil Engineering, third year. Mr. Carman, Mr. Bevan.

During part of the semester, field trips on Saturday morning will take the place of the laboratory work.

The application of the principles of geology to engineering. The study of the common rock-forming minerals and rocks, structural geology, dynamic geology and a briefer consideration of physiographic, historical and economic geology.

FOR GRADUATES

201-202. Advanced Historical Geology.

203-204. Research Work.

For description of graduate courses in this department see the Bulletin of the Graduate School.

GERMAN

Offices, 317 and 318 University Hall

PROFESSORS EVANS AND EISENLOHR, ASSISTANT PROFESSORS THOMAS, BARROWS, AND BUSEY, MR. KOTZ

101-102. Elementary German. Four credit hours. The year. Open to students in any four-year course who enter with a foreign language other than German.

The essentials of grammar and oral practice, first semester.

Reading of easy narrative, grammatical drill, second semester.

German 101 is given also during the second semester.

German 102 is given also during the first semester.

103. Intermediate German. Four credit hours. Either semester. Prerequisite, German 102 or two units entrance credit in German. Not open to students who enter with four units entrance credit in German.

Reading of narrative prose, with topical review of grammar. One hour prose composition each week.

German 103 is given also during the second semester.

106. Science Reading. Four credit hours. Second semester. This course is for engineering students; a continuation of German 103 and 107.

Rapid reading of German technical literature. Drill on sentence structure and word formation. The object of the course is to prepare students to read technical works and current technical literature.

107. Advanced German. Four credit hours. First semester. Open to first-year students who enter with four units credit in German. By agreement with the College of Engineering, students may, on securing permission, continue this course in the second semester in place of 106.

INDUSTRIAL ARTS AND SHOPWORK

Office, 125 Shop Building

PROFESSOR SANBORN, ASSOCIATE PROFESSOR W. A. KNIGHT, MR. CASE, MR. BEEM, MR. FOUST, MR. DENMAN, MR. BRECKUR, MR. P. L. WRIGHT, MR. BALMER, AND DEPARTMENT ASSISTANTS

INDUSTRIAL ARTS

112. Machine Design. Two credit hours. Second semester. Four laboratory hours each week. Electrical Engineering, fourth year. Prerequisite, Mechanics 102 and Engineering Drawing 111. Mr. Sanborn.

Practical application of principles of machine design.

114. Shop Building. Two credit hours. Second semester. Two recitations each week. Alternative with Mechanical Engineering 146, fourth year. Prerequisite, Civil Engineering 126. Mr. Sanborn.

Lectures and problems on the construction of shop buildings and the arrangement of machinery; special shop appliances.

For courses in Shopwork see page 82.

MATHEMATICS

Office, 314 University Hall

PROFESSORS BOHANNAN, McCOARD, SWARTZEL, KUHN, RASOR, AND MORRIS, ASSOCIATE PROFESSOR ARNOLD, ASSISTANT PROFESSORS PRESTON, BAREIS, AND REITZ, MISS RICKARD, MR. WEAVER, MR. BEATTY

131. College Algebra and Trigonometry. Five credit hours. Either semester. All four-year courses in Engineering, first year. Prerequisites, Entrance Algebra and Geometry. All instructors.

132. Plane Trigonometry and Analytical Geometry. Five credit hours. Either semester. All four-year courses in Engineering, first year. Prerequisite, Mathematics 131. All instructors.

This course is given also in the Summer Session.

141. Calculus. Five credit hours. Either semester. All four-year courses in Engineering, second year. Prerequisite, Mathematics 132. All instructors.

142. Calculus. Five credit hours. Either semester. Continuation of Mathematics 141. All four-year courses in Engineering, second year. Prerequisite, Mathematics 141. All instructors.

This course is given also in the Summer Session.

127-128. Analytical Geometry and Calculus. Three credit hours. The year. Architecture, second year. Prerequisite, Mathematics 132.

151. Differential Equations. One credit hour. First semester. Mechanical Engineering, third year. Prerequisite, Mathematics 142.

FOR ADVANCED UNDERGRADUATES AND GRADUATES

Prerequisite: Differential and Integral Calculus.

***163-164. Plane and Solid Analytical Geometry.** Three credit hours. The year. Miss Bareis.

167-168. Differential Equations. Three credit hours. The year. Mr. Bohannan.

173-174. Modern Higher Algebra. Three credit hours. The year. Mr. Kuhn.

FOR GRADUATES

201-202. Theory of Functions of a Complex Variable.

203. Fourier's Series and Spherical Harmonics.

204. Vector Analysis and its Applications.

205-206. Calculus of Variations.

207. History of Mathematics.

209-210. Theory of Statistics.

211-212. Groups.

213-214. Differential Geometry.

---

*Not given in 1919-1920.

215-216. Functions of a Real Variable.

217-218. Infinite Series and Products.

219-220. Theory of Numbers.

221-222. Theory of Invariants.

For description of graduate courses in this department see the Bulletin of the Graduate School.

MECHANICAL ENGINEERING

Office, 244 Robinson Laboratory

PROFESSORS MAGRUDER, MARQUIS, NORMAN, AND SANBORN, ASSOCIATE PROFESSOR JUDD, ASSISTANT PROFESSOR BROWN, MR. BUCHER, AND DEPARTMENT ASSISTANTS

101. Mechanism. Three credit hours. First semester. Three recitations each week. Electrical Engineering, third year. Prerequisites, Engineering Drawing 103, Physics 114. Mr. Norman.

Recitations on the principles of mechanism and mechanical movements.

103. Steam Power Plants. Three credit hours. First semester. Three recitations each week. Mechanical Engineering, third year. Prerequisites, Engineering Drawing 104 and Physics 119; concurrent, Mechanics 101 and Metallurgy 117 and 119. Mr. Marquis, Mr. Brown.

A descriptive and analytical study of steam-generating and steam-using machinery.

104. Steam Power Plants. Four credit hours. Second semester. Four recitations each week. Mechanical Engineering, third year. Prerequisites, Mechanical Engineering 103 and Metallurgy 117 and 119; concurrent, Mechanics 102. Mr. Marquis, Mr. Brown.

A continuation of Mechanical Engineering 103.

105-106. Heat Power Engineering. Three credit hours. The year. Three recitations each week. Electrical Engineering, third year. Prerequisites, Engineering Drawing 110 and

Physics 114; and concurrent, Mechanics 101 and 102. Mr. Bucher.

A descriptive and analytical study of steam-generating and steam-using machinery, gas and oil engines.

107. Steam Engineering. Three credit hours. First semester. Three recitations each week. Chemical Engineering, third year. Prerequisites, Engineering Drawing 104 and Physics 112.

An elementary descriptive and analytical study of steam-generating and steam-using machinery.

110. Mechanism and Machine Design. Three credit hours. Second semester. Three recitations each week. Ceramic Engineering, third year. Prerequisites, Engineering Drawing 104, Mechanics 101.

Recitations on the principles of mechanism, mechanical movements, elementary machine design, and power plants.

114. Mechanism. Three credit hours. Second semester. Three recitations each week. Mechanical Engineering, third year. Prerequisites, Engineering Drawing 104, Physics 119. Mr. Norman.

Recitations and practice on the principles of mechanism and mechanical movements.

116. Mechanism Drawing. One credit hour. Second semester. One three-hour drawing period each week. Mechanical Engineering, third year. Prerequisite or concurrent, Mechanical Engineering 114. Mr. Norman.

Practice in laying out mechanisms and mechanical movements.

121. Heating and Ventilating. Three credit hours. First semester. Three recitations each week. Architecture and Architectural Engineering, fourth year. Prerequisites, Mechanics 103, Physics 112 or 118. Mr. Brown.

Recitations and lectures on the principles and methods of heating and ventilation.

123. Materials of Construction. Two credit hours. First semester. One recitation and three laboratory hours each week.

Architectural Engineering, third year. Concurrent, Mechanics 103. Mr. Judd.

Lectures and recitations on the materials used in architectural and building construction, and laboratory exercises on their properties.

125. Gas Engines and Producers. Two credit hours. First semester. Two recitations each week. Mechanical Engineering, fourth year. Prerequisite, Mechanical Engineering 104. Mr. Magruder.

A study of gas engines and of gas producers as used for power purposes.

127. Machine Design. Five credit hours. First semester. Five recitations each week. Chemical and Mechanical Engineering, fourth year. Prerequisites, Engineering Drawing 104 and 111, Mechanics 101, Metallurgy 117 and 119, Mechanical Engineering 103 or 107. Mr. Norman.

A detailed course of study based upon mechanics and the materials of construction applied to the design and construction of machinery.

129. Thermodynamics. Two credit hours. First semester. Two recitations each week. Mechanical Engineering, fourth year. Prerequisite, Mechanical Engineering 104. Mr. Magruder.

The transmutations of heat and mechanical energies in steam and air engines, in air and ammonia compressors, and in refrigeration machines, together with a study of the tests of ideal and actual engines and of their indicator diagrams; the flow of gases through pipes and orifices.

130. Inspection Trip. Required in Mechanical Engineering, fourth year. Prerequisite, Mechanics 102.

Includes Pittsburgh, Buffalo, Niagara Falls, Cleveland, and possibly other places. The entire expense need not exceed $45. A satisfactory written report upon the work of the trip and examination are required.

134. Reading Course. Mechanical Engineering, fourth year. Written report on assigned reading upon processes of manufacture and power plant. This may be taken as a substitute for Mechanical Engineering 130 on presentation of reasons satisfactory to the head of the department.

142. Hydraulic Machinery. Two credit hours. Second semester. Two recitations each week. Mechanical Engineering, fourth year. Prerequisites, Mechanics 102, Mechanical Engineering 104 or 107, or 127 or 173. Mr. Judd.

A study of pumping machinery.

144. Machine Design. Five credit hours. Second semester. Three recitations and two three-hour drawing periods each week. Chemical and Mechanical Engineering, fourth year. Prerequisite, Mechanical Engineering 127. Mr. Norman.

A continuation of Mechanical Engineering 127, with practical applications on the drawing board of the principles to the design of some particular machine.

146. Steam Turbines. Two credit hours. Second semester. Two recitations each week. Optional in Mechanical Engineering with Mechanical Engineering 150 and Industrial Arts 114, fourth year. Prerequisite, Mechanical Engineering 129. Mr. Marquis.

A study of the generation of power by steam turbines, including auxiliary machinery.

148. Thesis Work. Three credit hours. Second semester. Mechanical Engineering, fourth year. Prerequisites, Mechanical Engineering 125, 127, 129, and 179. Mr. Magruder, Mr. Marquis, Mr. Judd.

A special investigation or design based upon the work of the courses.

150. Hydraulic Power. Three credit hours. Second semester. Two recitations and three laboratory hours each week. Elective in Civil and Electrical, and optional in Mechanical Engineering, fourth year. Prerequisites, Mechanical Engineering 173, 175, or 179. Mr. Judd.

A study of hydraulic turbines and the generation of hydraulic power.

160. Experimental Engineering Laboratory. Two credit hours. Second semester. Four laboratory hours each week. Electrical Engineering, third year. Concurrent, Mechanics 102 and Mechanical Engineering 106. Mr. Marquis, Mr. Bucher.

Calibration of pressure gauges and indicator springs; steam engine indicator practice; testing of lubricating oils and the materials of construction.

164. Experimental Engineering Laboratory. Two credit hours. Second semester. Four laboratory hours each week. Mechanical Engineering, third year. Concurrent, Mechanics 102 and Mechanical Engineering 104. Mr. Marquis, Mr. Brown, Mr. Bucher.

Calibration of pressure gauges and indicator springs; steam engine indicator practice; testing of oils and the materials of construction.

169. Experimental Engineering Laboratory. Two credit hours. First semester. Four laboratory hours each week. Architectural Engineering, fourth year. Concurrent, Mechanical Engineering 121. Mr. Marquis, Mr. Brown.

Investigations of the heating and ventilating plants of different buildings, lay-outs, and laboratory tests of equipments used in such plants.

171. Experimental Engineering Laboratory. Three credit hours. First semester. One recitation and four laboratory hours each week. Elective in Ceramic and Chemical Engineering, fourth year. Prerequisites, Mechanics 101 and 102 or 104. Mr. Judd.

Selected laboratory exercises in the testing of lubricants and the materials of construction; calibration of pressure gauges and indicator springs; steam engine indicator practice; and brake tests of steam engines.

173. Experimental Engineering Laboratory. Five credit hours. First semester. Two recitations and six laboratory hours each week. Civil Engineering, fourth year. Prerequisite, Mechanics 102. Mr. Marquis, Mr. Judd, Mr. Bucher.

Practice in the testing of the materials of construction; calibration of orifices and weirs; study of the flow of liquids and gases; tests of steam, power, rotary, and centrifugal pumps, tests of water motors and turbine water wheels. Lectures and recitations on same and on steam engines, boilers, and transmission machinery.

175. Experimental Engineering Laboratory. Three credit hours. First semester. Six laboratory hours each week. Electrical Engineering, fourth year. Prerequisites, Mechanical Engineering 106 and 160. Mr. Marquis, Mr. Judd, Mr. Brown, Mr. Bucher.

Tests of steam engines and boilers, of gas and oil engines, and of steam and power pumps; hydraulic experimentation; and the use of transmission and absorption dynamometers.

179. Experimental Engineering Laboratory. Two credit hours. First semester. Four laboratory hours each week. Mechanical Engineering, fourth year. Prerequisite, Mechanical Engineering 164. Concurrent, Mechanical Engineering 125 and 129. Mr. Marquis, Mr. Judd, Mr. Brown, Mr. Bucher.

Valve setting, moisture determinations in steam, gas calorimetry, measurements of flow of water by means of orifices, nozzles, weirs, and venturi-meter; tests of belts with use of transmission and absorption dynamometers.

190. Experimental Engineering Laboratory. Six credit hours. Second semester. Twelve laboratory hours each week. Mechanical Engineering, fourth year. Prerequisites, Mechanical Engineering 125, 129, and 179. Mr. Marquis, Mr. Judd, Mr. Bucher.

Tests of steam and hot-air engines; steam boilers; gas and and oil engines; gas producers; air compressors; injectors and pulsometers; centrifugal, rotary, and power pumps; hydraulic rams, impulse and turbine water wheels; fans and blowers, and steam turbines.

192. Experimental Engineering Laboratory. Three credit hours. Second semester. One recitation and four laboratory hours each week. Mine Engineering, fourth year. Prerequisites, Mechanics 102, Metallurgy 109. Mr. Judd, Mr. Bucher.

Lectures and recitations on power transmission, steam and gas engines, steam boilers, and gas producers. Laboratory work in the calibration of pressure gauges and indicator springs; valve setting; testing of steam engines, testing of steam and centrifugal pumps; boiler and fuel trials; tests of gas engines and gas producers.

FOR GRADUATES

201-202. Research Work.

203-204. Gas Power and Design.

205-206. Gas Power Laboratory Work.

207-208. Steam Power Plant Economics and Design.

209. The Steam Locomotive.

For description of graduate courses in this department see the Bulletin of the Graduate School.

MECHANICS

Office, 219 Lord Hall

PROFESSORS BOYD AND CODDINGTON, MR. DRAFFIN

The laboratory work in strength of material, involving the use of testing machines, is given at present in the department of Mechanical Engineering.

101. Statics and Strength of Materials. Five credit hours. First semester. Ceramic, Chemical, Civil, Electrical, Mechanical, and Mine Engineering, third year. Prerequisite, Mathematics 142. Mr. Boyd, Mr. Coddington, Mr. Draffin.

102. Strength of Materials: Kinetics and Hydraulics. Five credit hours. Second semester. Chemical, Civil, Electrical, Mechanical, and Mine Engineering, third year. Prerequisite, Mechanics 101. Mr. Boyd, Mr. Coddington, Mr. Draffin.

103. Statics and Strength of Materials. Five credit hours. First semester. Architecture and Architectural Engineering, third year. Prerequisite, Mathematics 128 or 142. Mr. Boyd.

104. Strength of Materials. Two credit hours. Second semester. Architecture and Ceramic Engineering, third year. Prerequisite, Mechanics 101. Mr. Boyd.

FOR GRADUATES

201-202. Advanced Theoretical Mechanics.

For description of graduate courses in this department see the Bulletin of the Graduate School.

METALLURGY

Office, 100 Lord Hall

PROFESSOR DEMOREST AND MR. E. C. SMITH

105. Fire Assaying. Two credit hours. First semester. Mine Engineering, third year. Laboratory three afternoons each week during the last two-fifths of the first semester. Prerequisite, Metallurgy 106 or equivalent. Mr. Demorest, Mr. Smith.

Lectures and laboratory work. Practical work in the assaying of gold, silver and lead ores.

106. Metallurgical Analysis. Four credit hours. Second semester. One lecture, nine laboratory hours each week. Mine Engineering, second year. Prerequisite, Chemistry 106 or 110, Chemistry 119. Mr. Demorest.

Lectures and laboratory work. Laboratory work in the analysis of iron ores, iron and steel, fuel and slags, and ores of lead, zinc, and copper by wet methods, using approved methods as practiced in technical laboratories and metallurgical works.

107. Alloy Analysis. Three credit hours. First semester. One lecture, laboratory three afternoons each week during the first three-fifths of the first semester. Mine Engineering, third year. Prerequisite, Metallurgy 106. Mr. Demorest.

Lectures and laboratory work. Laboratory work in the analysis of alloy steels, such as vanadium, tungsten, chromium, nickel and molybdenum steels and other alloys. Quantitative work preceded by qualitative test on the alloy.

117. Fuel. Two credit hours. First semester. Four recitations each week during first half of first semester. Chemical, Mechanical and Mine Engineering, third year; Ceramic Engineering, fourth year. Prerequisite, Chemistry 106 or 110 and Physics 112 or 114. Mr. Demorest.

Lectures, recitations and problems on fuels, their properties, uses and manufacture.

119. Iron and Steel. Two credit hours. First semester. A continuation of Metallurgy 117. Four recitations each week during second half of first semester. Chemical, Mechanical and Mine Engineering, third year; Ceramic Engineering, fourth year. Mr. Demorest.

Lectures, recitations and problems on metallurgy of iron and steel.

110. Metallurgy of Non-Ferrous Metals. Four credit hours. Second semester. Mine Engineering, third year. Mr. Demorest.

Lectures and recitations on the metallurgy and properties of the non-ferrous metals; copper, lead, gold, silver, aluminum, zinc.

111. Metallurgical Construction. Two credit hours. First semester. Two recitations during the first half of the first semester and four hours designing during the last half of the first semester. Mine Engineering, fourth year. Prerequisites, Engineering Drawing 111, Mechanics 102, Metallurgy 109 and 113. Mr. Demorest.

Lectures, recitations and practical applications in the drawing room on the designing of furnaces and metallurgical plants.

112. Technical Gas Analysis. Two credit hours. Second semester. Mine Engineering, third year. Two afternoons each week. Prerequisite, Metallurgy 106, 109, or equivalent. Mr. Demorest.

Laboratory work supplemented by lectures. Technical analysis of metallurgical and mine gases. Determination of the calorific value of gases; problems involving application of results of gas analysis to furnace operation, mine ventilation, etc.

113. Ore Dressing and Coal Washing. Two credit hours. First semester. Mine Engineering, fourth year. Prerequisite, Metallurgy 109. Mr. McCaughey.

Methods of concentrating and enriching ores and fuels by mechanical means. Lectures with references to standard books and various papers in technical journals.

120. Metallography. Two credit hours. Second semester. One hour lecture and three laboratory hours each week, first two-thirds of the semester. Mine Engineering, fourth year, alternate with Mine Engineering 120. Prerequisites, Metallurgy 106, 107, 119, or equivalent. Mr. Smith.

Metallography of iron, steel and industrial alloys. Methods of examination of iron, steel, brass, bronze bearing metals, etc. Relation of chemical composition, physical properties and microstructure of metal ores.

122. Pyrometry and Calorimetry. One credit hour. Second semester. Mine Engineering, fourth year. One lecture and three laboratory hours each week, last third of the semester. Prerequisites, Metallurgy 106, 107, 119 or equivalent. Mr. Smith.

Exercises in and lectures on the uses and calibration of noble and base metal thermo-couples, optical and radiation pyrometers, bomb calorimeters for liquid and solid fuels and the Junker calorimeter for gaseous fuels.

123. Metallography. Three credit hours. First semester. Elective. One lecture and four laboratory hours each week. Prerequisites, Metallurgy 106, 107, 119 or equivalent. Mr. Smith.

The study of freezing and cooling curves, equilibrium diagrams and their meaning, changes of structure in the solid state of pure metals and alloys, such as copper, steel, brass and bronze. Microscopic examination of commercial metallurgical products and methods of metallographic research.

125. Pyrometry. One credit hour. First semester. Three laboratory hours each week. Ceramic Engineering, fourth year. Mr. Smith.

Exercises in the measurement of high temperatures by standard pyrometric methods using noble and base metal thermocouples with galvanometer and potentiometer indicators, optical and radiation pyrometers and resistance thermometers and the calibration of pyrometers.

141. Metallurgical Investigation. Three to five credit hours. First semester. Prerequisites, one year of quantitative analysis, college physics, and not less than one semester of general metallurgy. Mr. Demorest.

(a) Iron, Steel and other Alloys. Investigations on the composition, properties, structure and heat treatment. Prerequisite, Metallurgy 114.

(b) Fuels. Investigations on composition, conservation and utilization. Prerequisite, Metallurgy 114.

(c) Investigations on the Metallurgy and Analysis of the Less Common Metals, as tin, antimony, bismuth, tungsten, etc. Prerequisite, Metallurgy 109.

(d) Investigation of Special Metallurgy Processes, as the electrolytic refining of lead, etc. Prerequisite, Metallurgy 109.

116. Thesis. Three credit hours. Second semester.

MILITARY SCIENCE AND TACTICS

Office, 104 Hayes Hall

LIEUT. COLONEL LEONARD, U. S. A., CAPTAIN HALSTEAD, U. S. A., SERGEANTS MADDEN AND O'ROURKE, MR. BRUDER

In accordance with the Morrill Act, passed in 1862, under which the University was established, military instruction must be included in the curriculum. The Board of Trustees therefore requires all male students, both special and regular, *unless excused by the Military and Gymnasium Board,* to drill during two years. Under ordinary circumstances this work is under three commissioned officers of the regular army, detailed for the purpose. The Military Department offers instruction during four days each week throughout the year.

1. Military Drill. One credit hour. Five months, three hours each week (divided between fall and spring), military drill; four months, three hours each week (winter), of class-room instruction in drill regulations. Target practice at any open hour during the afternoon of the winter months, at 100, 200 and 300 yards. Lecture, one hour each week, by the President, upon topics of common interest to the student body.

2. Military Drill. One credit hour. Five months, three hours each week (divided between fall and spring), in extended order and guard duty; four months, three hours each week (winter), of class-room instruction in Articles of War, guard manual, and field service regulations; target practice at any open hour of the afternoon of the winter months, at 500, 600, and 800 yards.

MINE ENGINEERING

Office, 200 Lord Hall

PROFESSOR RAY, ASSISTANT PROFESSOR NOLD

103. Mine Surveying. Four credit hours. First semester. Mine Engineering, second year; Ceramic Engineering, third year. Prerequisites, Engineering Drawing 102, Mathematics 132. Mr. Ray, Mr. Nold.

Recitations and field practice in the use of instruments for surface and undergound surveys. Field notes are taken and maps and plans made in the drawing room.

104. Plans and Specifications. Four credit hours. Second semester. Mine Engineering, fourth year. Prerequisite, Mine Engineering 105, Metallurgy 111. Mr. Ray, Mr. Nold.

Practice in designing mine plants, drafting, and estimating.

105-106. Mine Engineering. Five credit hours. The year. Mine Engineering, fourth year. Prerequisites, Mechanics 102, Mine Engineering 103, Geology 165. Mr. Ray, Mr. Nold.

Lectures and recitations on prospecting, shaft sinking, methods of mining, mine operating, mining machinery, haulage, hoisting, drainage, ventilation, valuation, etc. Constant reference is required to standard works and to the leading technical journals.

109-110. Mine Trip. One credit hour. The year. Prerequisite or concurrent, Mine Engineering 103, or equivalent. Mr. Nold.

Two or three day trip to Ohio coal mines. The students make a survey of a portion of the mine, and a supervised inspection is made of the mine workings. A written report covering the work of the trip is required.

117. Mining Problems. Two credit hours. First semester. Two recitations each week. Mine Engineering, third year. Prerequisities, Mine Engineering 103, 109, or 110. Mr. Nold.

Practice in the solution of engineering problems pertaining to mine projections, shafts, slopes, drifts for coal and metal mining.

120. Ventilation Control and Safety Appliances. Two credit hours. Second semester. Mine Engineering, fourth year, alternate with Metallurgy 120. Two afternoons each week, first two thirds of second semester. Prerequisites, Metallurgy 112 and Mine Engineering 105. Mr. Nold.

Laboratory work on mine illumination, ventilation and the use of safety appliances.

116. Thesis. Three credit hours. Second semester. Mr. Ray, Mr. Nold.

FOR GRADUATES

201-202. Research Work.

For description of graduate courses in this department see the Bulletin of the Graduate School.

MINERALOGY

Office, 104 Lord Hall

PROFESSOR McCAUGHEY

102. Crystallography and Mineralogy. Three credit hours. Either semester. Mine Engineering, second year; Chemical Engineering, third year. Prerequisite, Chemistry 106 or 110.

Lectures on crystallography, physical and descriptive mineralogy. Illustrated by drawings, models, and mineral specimens.

104. Determinative Mineralogy. Three credit hours. Second semester. One lecture, six laboratory hours each week. Mine Engineering, third year. Prerequisite, Mineralogy 102.

Lectures and laboratory work in practical determination of minerals by physical and chemical tests. Each student is furnished with a set of apparatus and works under an instructor's inspection. Brush and Penfield's "Determinative Mineralogy" is used as a manual.

105. Physical Chemical Mineralogy. Two credit hours. First semester. Ceramic Engineering, fourth year. Prerequisites, Chemistry 159, Ceramic Engineering 108. Mr. McCaughey.

Thermal properties of minerals, their formation and transformation in silicate mixtures.

121. Microscopic Mineralogy. Three to five credit hours. First semester. One lecture and four to eight laboratory hours each week. Prerequisites, Mineralogy 102 and Physics 114.

The use of the polarizing microscope in the identification of minerals in fine powder and in thin section. Determination of the optical constants of minerals and crystallized bodies with the polarizing microscope.

123-124. Microscopic Petrography. Five credit hours. The year. Elective. One lecture each week, four two-hour laboratory periods. Prerequisites, Mineralogy 102, Geology 165, 166. Mr. McCaughey.

Optical mineralogy. The determination and study of rock-forming minerals and rocks in hand specimen and thin section. The mineralogical and chemical composition of igneous and metamorphic rocks.

126. Advanced Crystallography and Physical Mineralogy. Three credit hours. Second semester. Two lectures and three laboratory hours each week. Prerequisites, Physics 114, Mineralogy 102.

The study of the geometrical and physical properties of crystals. Laboratory work on the measurement, calculation, and projection of crystals and the determination of the physical and optical constants of crystallized bodies.

PHYSICAL EDUCATION

Office, The Gymnasium

PROFESSORS ST. JOHN, WILCE, CASTLEMAN, AND NICHOLS,
ASSISTANT PROFESSOR TRAUTMAN, MR. OHLSON, MR. BIRD

101-102. Physical Education. One credit hour. The year. Two hours each week. Required of all first-year students. During the first semester the course consists of one lecture on personal hygiene and one period of active physical exercise each week.

Personal Hygiene: Lectures and quizzes on the cause, prevention, and hygienic treatment of the common preventable diseases and conditions which lower the vitality and interfere with the health and efficiency of the students.

Physical Exercise in Class: A graded course of free-hand exercises, with light hand apparatus for the relief and correction of slight bodily defects, improper carriage, etc. Progressive exercises on the apparatus and mats, to promote muscular tone, organic vigor, bodily skill, etc. Dancing, gymnastic and athletic games and contests.

PHYSICS

Office, 107 Physics Building

PROFESSORS COLE, EARHART, BLAKE, SHEARD, AND ALPHEUS W. SMITH, ASSISTANT PROFESSOR HEIL, MR. WOODBURY, MR. ALVA W. SMITH, MR. DITTO, MR. SERVICE, AND DEPARTMENT ASSISTANTS

111. General Physics. Three credit hours. First semester. Two recitations and two laboratory hours each week. Architectural, Ceramic, Chemical, Civil, and Mine Engineering, second year. Prerequisite, entrance physics and Mathematics 132. All instructors.

112. General Physics. Three credit hours. Second semester. Two recitations and two laboratory hours each week. Ceramic, Chemical and Mine Engineering, second year. Prerequisite, Physics 111.

A continuation of Physics 111.

113. General Physics. Five credit hours. First semester. Electrical Engineering, five recitations each week; Mechanical Engineering, four recitations, and two laboratory hours each week. Electrical and Mechanical Engineering, second year. Prerequisite, elementary physics and Mathematics 132. All instructors.

Mechanics and heat.

114. General Physics. Four credit hours. Second semester. Four recitations on general text each week. Electrical Engineering, second year. Prerequisite, Physics 113. Mr. Alpheus Smith, Mr. Alva Smith.

117. General Physics. Two credit hours. First semester. Two recitations each week in mechanics, acoustics and heat with demonstrations. Architecture, second year. Prerequisite, entrance physics and Mathematics 132. Mr. Cole.

118. General Physics. Two credit hours. Second semester. Two recitations each week in electricity and light with demonstrations. Architecture, second year. Prerequisite, Physics 117. Mr. Cole.

119. General Physics. Three credit hours. Second semester. Three recitations each week. Mechanical Engineering, second year. Prerequisite, Physics 113. Mr. Cole, Mr. Woodbury.

125. General Physics. Five credit hours. Second semester. Four recitations on text, and two laboratory hours each week. Civil Engineering, second year. Prerequisite, Physics 111. Mr. Earhart.

133. Physical Laboratory. Two credit hours. First semester. Four laboratory hours each week. Electrical Engineering, second year. Concurrent, Physics 113. Mr. Smith, Mr. Heil.

134. Electrical Measurements. Four credit hours. Second semester. One recitation and six hours laboratory work each week. Electrical Engineering, second year. Concurrent, Physics 114. Mr. Alpheus Smith, Mr. Alva Smith, Mr. Ward.

135. Electrical Measurements and Photometry. Five credit hours. First semester. Two recitations and six laboratory hours each week. A continuation of Physics 134. Electrical Engineering, third year. Prerequisites, Physics 114 and 134, Mathematics 141-142. Mr. Alpheus Smith, Mr. Alva Smith, Mr. Ward.

136. Physical Laboratory. Four credit hours. Second semester. Six laboratory hours each week, in electrical measurements; two laboratory hours each week, in mechanics and heat experiments. General Engineering, second year. Concurrent, Physics 114 and Mathematics 142. Mr. Alva Smith, Mr. Ward.

137. Physical Laboratory. Three to five credit hours. First semester. Prerequisite or concurrent, Physics 111. Elective.

138. Physical Laboratory. Two credit hours. Second semester. Four laboratory hours each week. Mechanical Engineering, second year. Prerequisite, Physics 111; concurrent, Physics 112. Elective, three to five credit hours. Mr. Blake, Mr. Heil.

139-140. Advanced Electrical Measurements. Three to five credit hours. The course may be elected either semester. Prerequisite, Physics 135 or equivalent. Mr. Alva Smith.

This course is subject to considerable variation to meet the needs of individual students, but a large amount of time is always devoted to oscillography work.

123-124. Advanced Laboratory. Three to five credit hours. The year. Prerequisite, Physics 121-122. Mr. Smith.

144. Electricity. Three credit hours. Second semester. Prerequisite, Physics 103-104 or 105-106; calculus should precede or accompany. Mr. Earhart.

FOR GRADUATES

201-202. Research Laboratory.

***203-204. Theoretical Mechanics.**

205-206. Thermodynamics and Electrolytic Conduction.

***207-208. Theory of Electricity and Magnetism.**

211-212. Theory of Oscillations with Applications to Wireless Telegraphy.

213-214. Conduction of Electricity Through Gases and Radio-activity.

***215-216. Electromagnetic Theory.**

For description of graduate courses in this department see the Bulletin of the Graduate School.

ROMANCE LANGUAGES AND LITERATURES

Office, 305 University Hall

PROFESSORS BOWEN AND INGRAHAM, ASSISTANT PROFESSORS HAMILTON, CHAPIN, PEIRCE, GUIGOU, AND HACKER, MR. GUTIERREZ, MR. BERTHEMY, MR. TAILLIART, MR. WILLIAMS, MRS. ARTHUR, MISS HIER, MR. YOUNG, AND DEPARTMENT ASSISTANTS

FRENCH

101-102. Elementary French. Four credit hours. The year. Four recitations each week. May be taken by students in any four-year course who enter with no entrance credits in

---

*Not given in 1919-1920.

French. Text-books: Fraser and Squair's Grammar, or equivalent, and Aldrich and Foster's or Bowen's First Scientific Reader. Historical and narrative prose; one or more prose comedies. All instructors.

Stress is laid first upon the acquisition of a correct pronunciation, after which the energy of the student is directed toward the attainment of (1) an accurate reading knowledge of the language, and (2) facility in speaking and understanding it. Grammar and composition are made to contribute to these ends.

French 101 is given also during the second semester.

French 102 is given also during the first semester.

103. Modern French Literature. Four credit hours. First semester. Four recitations each week. May be taken by first-year students in any four-year course who enter with two units entrance credit in French. Prerequisite, French 101-102, or two entrance credits. All instructors.

The work of the year deals with the following subjects: (1) Contes; (2) The novel (Balzac or Hugo); (3) Lyric poetry; (4) Romantic drama (Hugo). Prose composition, with practice in speaking. Systematic attention given to syntax and idiom. Lectures supplement the work. Private reading required.

French 103 is given also during the second semester.

106. Science Reading. Four credit hours. Second semester. Four recitations each week. Must be taken by students in Engineering who take French 103 during the first semester. Mr. Berthemy.

A course of rapid reading introductory to the vocabulary of scientific literature.

SPANISH

101-102. Elementary Spanish. Four credit hours. The year. Four recitations each week. May be taken by students in any four-year course who enter with no entrance credit in Spanish. All instructors.

The elements of Spanish grammar with abundant oral and written exercises. Elementary reading as a basis for oral and written practice.

Spanish 101 is given also during the second semester.

103-104. Intermediate Spanish. Four credit hours. The year. Four recitations each week. May be taken by students who enter with two units entrance credit in Spanish. Prerequisite, Spanish 101-102, or two units entrance credit. Mr. Chapin, Mr. Gutierrez.

A more comprehensive survey of the form and syntax, with more advanced reading as a basis for practice in speaking and writing.

110. Commercial Reading and Correspondence. Four credit hours. Second semester. Prerequisite, Spanish 103. Mr. Chapin.

A course designed to familiarize students with the vocabulary of business and with the forms of Spanish commercial paper and correspondence.

SHOPWORK

Office, 125 Shop Building

For courses in Industrial Arts see page 61.

PROFESSOR SANBORN, ASSOCIATE PROFESSOR W. A. KNIGHT, MR. CASE, MR. BEEM, MR. FOUST, MR. DENMAN, MR. BRECKUR, MR. P. L. WRIGHT, MR. BALMER, AND DEPARTMENT ASSISTANTS

105. Foundry Work. Two credit hours. Either semester. One recitation and four laboratory hours each week. Mechanical Engineering, second year. Mr. Breckur.

Exercises and practice on tempering sand and preparing molds of machine parts in sand, core-making, melting iron and brass, and pouring.

107. Chipping and Filing. Two credit hours. Either semester. One recitation and four laboratory hours each week. Mechanical Engineering, second year. Ceramic Engineering, alternative with 109 and 115, Summer Session. Mr. Case.

Exercises and practice in vise work including chipping in cast and wrought iron, surface filing, squaring, fitting, finishing, the scraping of surface plates, soldering and brazing.

109. Joinery and Pattern-Making. Two credit hours.

Either semester. One recitation and four laboratory hours each week. Ceramic Engineering alternative with Shopwork 107 and 115. Chemical Engineering, Electrical Engineering, Mechanical Engineering, and Mine Engineering, during the Summer Session at the close of the first year. Mr. Beem, Mr. Denman.

Exercises and practice in joinery, wood-turning, and pattern-making, including sawing, planing, mortising, framing, and other work involving the use of the ordinary carpenter tools, center and chuck-turning, and making of finished patterns.

111. Advanced Pattern-Making. One credit hour. Either semester. Three laboratory hours each week. Mechanical Engineering, second year. Prerequisite, Shopwork 109. Mr. Beem.

115. Forging. Two credit hours. Either semester. One recitation and four laboratory hours each week. Ceramic, Chemical, Electrical, Mechanical and Mine Engineering during the Summer Session at the close of the first year. Mr. Foust, Mr. Wright.

The use and care of forge, fire, and tools. Practice in iron and steel forging, including such operations as cutting, bending, drawing, upsetting, shaping, and welding iron; the making, hardening, and tempering of steel punches, chisels, and lathe tools.

118. Advanced Forging. Two credit hours. Second semester. Six laboratory hours each week. Elective. Prerequisite, Shopwork 115. Mr. Foust, Mr. Wright.

Various forms of welds in iron and steel; the use of scrolling irons and of forms for duplicating work; annealing; tool-making, case-hardening; tempering drills, dies, and cutters; spring-making; ornamental iron work; visits to shops.

119. Machine Work. Three credit hours. Either semester. One recitation and six laboratory hours each week. Electrical and Mechanical Engineering, second year. Mr. Case, Mr. H. R. Wright.

Elementary exercises on engine lathe, such as plain, straight and taper turning, screw cutting, chucking; boring, filing, and polishing, and the use of the drill press.

121. Advanced Machine Work. Three credit hours. Either semester. One recitation and six laboratory hours each week. Mechanical Engineering, third year. Electrical Engineering, second year. Prerequisite, Shopwork 119. Mr. Knight, Mr. Case, Mr. H. R. Wright.

A continuation of Shopwork 119 with more difficult exercises on the lathe, including square thread cutting, drilling, and tapping, use of steady rest, face-plate work, and bar turning. Also practice on the milling machines, planer, shaper and turret lathe.

123. Advanced Machine Work. Two credit hours. First semester. Six laboratory hours each week. Elective. Prerequisite, Shopwork 121. Mr. Knight, Mr. Case, Mr. H. R. Wright.

A more advanced course in milling machine work and grinding. Exercises in spur and spiral gear cutting, cam cutting, and differential and fractional indexing.

125. Construction Work. Two credit hours. Either semester. Six laboratory hours each week. Elective. Prerequisite, Shopwork 121. Mr. Knight, Mr. Case, Mr. H. R. Wright.

A course in construction work on any piece of apparatus or machinery which may be in course of construction in the shops.

127. Tool-Making and Jig Work. Three credit hours. Either semester. Elective. Prerequisite, Shopwork 123. Mr. Knight, Mr. Case.

FOR GRADUATES

201-202. Research Work.

For description of graduate courses in this department see the Bulletin of the Graduate School.

SPANISH

(See Romance Languages)

The Ohio State University Bulletin is published at least twenty times during the year as follows: Monthly in June, July, August, and September, and bi-weekly in October, November, December, January, February, March, April, and May.

PRESS OHIO STATE REFORMATORY

UNIVERSITY OF ILLINOIS-URBANA
3 0112 112242158